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DEPARTMENT OF ENERGY
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos, New Mexico 87544

OCT 2 3 2019

Mr. John E. Kieling
Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Dear Mr. Kieling:

Subject: Submittal of the Phase II Investigation Work Plan for Delta Prime Site Aggregate Area Sites at Delta Prime East and Delta Prime West

Enclosed please find two hard copies with electronic files of the "Phase II Investigation Work Plan for Delta Prime Site Aggregate Area Sites at Delta Prime East and Delta Prime West." This Phase II investigation work plan addresses sampling to define extent and corrective actions for five sites within the Delta Prime (DP) Site Aggregate Area at Technical Area 21. Three of the sites have previously been investigated [Solid Waste Management Units (SWMUs) 21-011(b) and 21-022(h) and Area of Concern (AOC) 21-028(d)] and the results of the investigation and/or remediation activities conducted at these sites were reported in the "Investigation Report for DP Site Aggregate Area Sites at DP East, Revision 1," submitted to the New Mexico Environment Department (NMED) in December 2018, and the "Phase III Investigation Report for Delta Prime Site Aggregate Area at Technical Area 21, Revision 1," submitted to NMED in July 2016. These investigation reports recommended additional sampling to define extent, removal of subsurface structures, and/or removal of contaminated soil exceeding cleanup levels. The remaining two sites (AOCs C-21-001 and C-21-006) have not been previously sampled because of their locations adjacent to or beneath structures, which have since been removed.

The following sites require additional sampling to define lateral or vertical extent and removal of contaminated soil and/or structures:

- SWMU 21-011(b)
- AOC 21-028(d)

The following sites require investigation to define the nature and extent of contamination and evaluate risk to human health and ecological receptors:

- AOC C-21-001
- AOC C-21-006

The following site requires removal of contaminated soil:

- SWMU 21-022(h)

The attached Phase II investigation work plan presents the proposed sampling and analyses and remediation activities needed at each site.

Pursuant to Section XXIII.C of the Compliance Order on Consent, a pre-submission review meeting was held with the U.S. Department of Energy Environmental Management Los Alamos Field Office (EM-LA); Newport News Nuclear BWXT-Los Alamos, LLC (N3B); and NMED on October 9, 2019.

If you have any questions, please contact Duane Parsons at (505) 551-2961 (duane.parsons@em-la.doe.gov) or Cheryl Rodriguez at (505) 257-7941 (cheryl.rodriguez@em.doe.gov).

Sincerely,

Arturo Q. Duran
Compliance and Permitting Manager
Environmental Management
Los Alamos Field Office

Enclosures:
1. Two hard copies with electronic files – Phase II Investigation Work Plan for Delta Prime Site Aggregate Area Sites at Delta Prime East and Delta Prime West (EM2019-0283)

cc (letter with hard-copy enclosure[s]):
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Phase II Investigation Work Plan for Delta Prime Site Aggregate Area Sites at Delta Prime East and Delta Prime West

N3B Los Alamos

EM2019-0283

Phase II Investigation Work Plan for Delta Prime Site Aggregate Area Sites at Delta Prime East and Delta Prime West

October 2019

Responsible program director:

Printed Name	Signature	Title	Organization	Date
Michael O. Erickson		Program Director	RCRA Remediation Program	9/30/19

Responsible N3B representative:

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Erich Evered		Program Manager	N3B Environmental Remediation Program	10/1/2019

Responsible DOE EM-LA representative:

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Arturo Q. Duran		Compliance and Permitting Manager	Office of Quality and Regulatory Compliance	10/1/2019

EXECUTIVE SUMMARY

This Phase II investigation work plan addresses sampling to define extent and corrective actions for five sites within the Delta Prime (DP) Site Aggregate Area at Technical Area 21. Three of the sites have previously been investigated [Solid Waste Management Units (SWMUs) 21-011(b) and 21-022(h) and Area of Concern (AOC) 21-028(d)], and the results of the investigation and/or remediation activities conducted at these sites were reported in the "Investigation Report for DP Site Aggregate Area Sites at DP East, Revision 1," submitted to the New Mexico Environment Department (NMED) in December 2018 and the "Phase III Investigation Report for Delta Prime Site Aggregate Area at Technical Area 21, Revision 1," submitted to NMED in July 2016. These investigation reports recommended additional sampling to define extent, removal of subsurface structures, and/or removal of contaminated soil exceeding cleanup levels. The remaining two sites (AOCs C-21-001 and C-21-006) have not been previously sampled because of their locations adjacent to or beneath structures, which have since been removed.

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- AOC C-21-006

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- SWMU 21-022(h)

This Phase II investigation work plan presents the proposed sampling and analyses and remediation activities needed at each site.

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1.0 INTRODUCTION

Los Alamos National Laboratory (LANL or the Laboratory) is a multidisciplinary research facility owned by the U.S. Department of Energy (DOE). The Laboratory is located in north-central New Mexico, approximately 60 mi northeast of Albuquerque and 20 mi northwest of Santa Fe. The Laboratory site covers 36 mi^2 of the Pajarito Plateau, which consists of a series of fingerlike mesas that are separated by deep canyons containing perennial and intermittent streams running from west to east. Mesa tops range in elevation from approximately 6200 ft to 7800 ft above mean sea level.

The Laboratory has been a participant in a national effort by DOE to clean up sites and facilities formerly involved in weapons research and development. The goal of this effort is to ensure past operations do not threaten human or environmental health and safety in and around Los Alamos County, New Mexico. To achieve this goal, the Laboratory has investigated sites potentially contaminated by past Laboratory operations. These sites are designated as either solid waste management units (SWMUs) or areas of concern (AOCs).

This Phase II investigation work plan addresses SWMUs and AOCs within the Delta Prime (DP) Site Aggregate Area at the Laboratory. These sites are potentially contaminated with hazardous chemicals and radionuclides. The New Mexico Environment Department (NMED), pursuant to the New Mexico Hazardous Waste Act, regulates cleanup of hazardous wastes and hazardous constituents. DOE regulates cleanup of radioactive contamination, pursuant to DOE Order 458.1, Administrative Change 3, "Radiation Protection of the Public and the Environment," and DOE Order 435.1, "Radioactive Waste Management." Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to NMED in accordance with DOE policy.

Corrective actions at Laboratory sites are subject to a Compliance Order on Consent (the Consent Order) issued by NMED. This investigation work plan describes work activities that will be completed in accordance with the Consent Order.

1.1 Work Plan Overview

The DP Site Aggregate Area is located in Technical Area 21 (TA-21) at the Laboratory (Figure 1.1-1). Table 1.1-1 lists the five sites addressed in this investigation work plan, along with a brief description for each site and the site status. The site status refers to the investigations and/or remediation completed to date. Three of the sites have previously been investigated and the results of the investigation and/or remediation activities conducted at these sites were reported in the "Investigation Report for DP Site Aggregate Area Sites at DP East, Revision 1," submitted to NMED in December 2018 (N3B 2018, 700160) and the "Phase III Investigation Report for Delta Prime Site Aggregate Area at Technical Area 21, Revision 1" submitted to NMED in July 2016 (LANL 2016, 601598).

Three of the sites [SWMUs 21-011(b) and 21-022(h) and AOC 21-028(d)] require additional sampling to define nature and extent and/or require removal of contaminated soil and/or subsurface structures. The other two sites (AOCs C-21-001 and C-21-006) have not been accessible for sampling because of their locations adjacent to or beneath structures, which have since been removed.

This Phase II investigation work plan presents the proposed sampling and analyses needed to define the vertical and/or lateral extent and remediation activities needed to remove contaminated soil and structures. Contaminants to be investigated include inorganic and organic chemicals and radionuclides.

Section 2 presents the background and conceptual site model of the DP Site Aggregate Area. Section 3 summarizes site conditions, and section 4 presents site descriptions and the scope of proposed activities for each site. Section 5 describes investigation methods for proposed field activities. Ongoing monitoring and sampling programs within the aggregate area are summarized in section 6. Section 7 is an overview of the anticipated schedule of the investigation and reporting activities. The references cited in this Phase II work plan and the map data sources are provided in section 8. Appendix A of this work plan includes a list of acronyms and abbreviations, a metric conversion table, and a data qualifier definitions table. Appendix B describes the management of wastes generated during implementation of the work plan.

1.2 Work Plan Objectives

This Phase II work plan has been developed to support the objectives of (1) completing the activities recommended for two of the sites [SWMU 21-011(b) and AOC 21-028(d)] in a previous investigation report (N3B 2018, 700160), (2) investigating two sites (AOCs C-21-001 and C-21-006) that could not previously be investigated, and (3) removing soil contaminated above soil screening levels (SSLs) at one site [SWMU 21-022(h)].

To support the accomplishment of these objectives, the Phase II work plan

- describes each site and its operating history,
- summarizes existing information on nature and extent of contamination,
- describes the rationale for proposed data collection activities,
- identifies and presents appropriate methods for achieving the investigation objectives and managing wastes, and
- describes the process for conducting the investigation activities and reporting the investigation results within a schedule prescribed by the Consent Order.

2.0 BACKGROUND

2.1 General Site Information

TA-21 is located on DP Mesa on the northern boundary of the Laboratory and is immediately east-southeast of the Los Alamos townsite (Figure 1.1-1). It extends from the mesa top to the stream channels in two adjacent canyons, DP Canyon to the north and Los Alamos Canyon to the south.

2.2 Operational History

During World War II, the Laboratory was established for the research, development, and testing of the first deliverable nuclear weapon. In 1945, the operations for establishing the chemical and metallurgical properties of the nuclear material necessary to achieve and sustain the nuclear fission reaction were transferred to newly built facilities at TA-21.

DP West operations began in September 1945, primarily to produce metal and alloys of plutonium from nitrate solution feedstock provided by other production facilities. This procedure involved several acid dissolution and chemical precipitation steps to separate the plutonium and other valuable actinides from the feedstock. A major research objective at DP West was the development of new purification techniques that would increase the efficiency of the separation processes (Christensen and Maraman

1969, 004779). Details of the purification techniques are discussed in the operable unit work plan for TA-21 (LANL 1991, 007529). Other operations performed at DP West included nuclear fuel reprocessing. In 1977, transfer of work to the new plutonium facility at TA-55 began and much of the DP West complex was vacated.

DP East operations also began in September 1945. These facilities were used to process polonium and actinium and to produce initiators (a nuclear weapons component). From 1952 through 1973 the facilities supported the Rover nuclear propulsion project. In 1964, building 21-209 was built to house research into high-temperature and actinide chemistry. Following the Rover project, the facilities supported fusion research. Building 21-155 housed the Tritium Systems Test Assembly (TSTA) for developing and demonstrating effective technology for handling and processing deuterium and tritium fuels used in fusion reactors. Operations ceased and the DP East facilities were placed in safe shutdown in 2003.

All operations at TA-21 have ceased and none of the sites are active sources that continue to release contamination. The majority of the structures at TA-21 have undergone decontamination and decommissioning (D&D) beginning in 2009. Nearly all the buildings have been removed to the foundations, some areas have been remediated, and septic tanks are not receiving any discharges; all sumps and septic tanks are disconnected from their sources, some tanks have been removed, some have been filled and left in place, or some have been emptied and left in place. Roads and large paved parking areas remain and many unpaved areas are landscaped. The material disposal areas (MDAs) and the main TA-21 area are fenced for controlled access. Currently, TA-21 is under DOE ownership and control and will be transferred to Los Alamos County in the future for industrial use only.

2.3 Conceptual Site Model

The sampling proposed in this Phase II work plan uses a conceptual site model to predict areas of potential contamination and to allow for adequate characterization of these areas. A conceptual site model describes potential contaminant sources, transport mechanisms, and receptors.

2.3.1 Potential Contaminant Sources

Releases at the sites addressed within this work plan may have occurred as a result of potential leaks from waste lines, drains, and sumps [SWMU 21-011(b)], discharges from an outfall [(SWMU 21-022(h)], and spills [AOCs 21-028(d), C-21-001, and C-21-006].

2.3.2 Potential Contaminant Transport Mechanisms

Potential transport mechanisms that may lead to exposure include

- dissolution and/or particulate transport of surface contaminants during precipitation and runoff events,
- water line breaks resulting in sheet flow,
- preferential flow paths along buried utility lines,
- airborne transport of contaminated surface soil,
- continued dissolution and advective/dispersive transport of contaminants contained in subsurface soil and tuff,
- infiltration of water through the vadose zone,

- disturbance of contaminants in shallow soil and subsurface tuff by construction, D&D, or Laboratory operations,
- biotic perturbation and translocation in subsurface contaminated media including shallow soil, and
- disturbance and uptake of contaminants in shallow soil by plants and animals (bioturbation).

2.3.3 Potential Receptors

Potential receptors at one or more of the sites include on-site and nearby Laboratory workers, construction/D&D workers, hikers in DP Canyon, plants, and/or animals.

2.3.4 Cleanup Levels

As specified in the Consent Order, SSLs for inorganic and organic chemicals (NMED 2019, 700500) are used as soil cleanup levels unless they are determined to be impracticable or values do not exist for the current and reasonably foreseeable future land uses. Screening action levels (SALs) are used as soil cleanup levels for radionuclides (LANL 2015, 600929). Screening assessments compare chemical of potential concern (COPC) concentrations for each site with industrial, residential, and construction worker SSLs and SALs. Consistent with planned future land use, sites within TA-21 will be cleaned up to meet cleanup goals for the industrial and construction worker scenarios.

The cleanup goals specified in Section VIII of the Consent Order are a target risk of 1×10^{-5} for carcinogens or a hazard index (HI) of 1 for noncarcinogens. For radionuclides, the target dose is 25 mrem/yr as authorized by DOE Order 458.1.

3.0 SITE CONDITIONS

Surface and subsurface features and geologic characteristics of the DP Site Aggregate Area are described in detail in previous investigation reports (LANL 2016, 601598; N3B 2018, 700160). Conditions at the sites addressed in this Phase II investigation work plan are predominantly influenced by

- a semiarid climate with low precipitation and a high evapotranspiration rate that limits the extent of subsurface moisture percolation and, therefore, the amount of moisture available to transport radionuclides or hazardous waste constituents in the subsurface, and
- a thick, relatively dry, unsaturated (vadose) zone that greatly restricts or prevents downward migration of contaminants to the regional aquifer.

These and other elements of the environmental setting in the DP Site Aggregate Area are considered when the investigation data are evaluated with respect to the fate and transport of contaminants.

4.0 SITE DESCRIPTIONS AND PROPOSED INVESTIGATION ACTIVITIES

4.1 SWMU 21-011(b), Sump and Acid Waste Lines

4.1.1 Site Description

SWMU 21-011(b) is a former radioactive liquid waste (RLW) sump pump (former structure 21-223) that was located approximately 760 ft east of the RLW treatment facility (RLWTF) in building 21-257 and 70 ft northwest of the former TSTA (building 21-155) east of MDA T at TA-21 and associated acid waste lines.

The sump pump was located inside a small metal building (no structure number assigned) and consisted of a subsurface concrete sump with inlet and outlet waste lines and a mechanical pump. Structure 21-223 was constructed in 1965 and served as a pump house for transporting RLW from DP East facilities to the former TA-21 RLWTF in former building 21-35 [SWMU 21-010(a)] through a 3-in. waste line. In 1965, 6-in. drainlines were installed to transport RLW from building 21-155 to the RLW sump pump (former structure 21-223). The sump pump was also connected to a 6-in. vitrified clay overflow pipe, which discharged to DP Canyon [AOC 21-004(d)], eventually running into the same area as the discharge from the SWMU 21-024(h) septic system. The SWMU 21-024(h) outfall was addressed in the DP Site Phase I and Phase II Consent Order investigations (LANL 2008, 102760; LANL 2010, 110772.4).

In 1967/1968, building 21-35 was removed and the 3-in. sump pump outlet waste line was extended to the new RLWTF in building 21-257 [SWMU 21-011(a)]. Building 21-257 is located within the MDA T fence. In 1979, the sump overflow pipe was connected to the aboveground stainless-steel storage tanks [structure 21-346, SWMUs 21-004(b) and 21-004(c)]. In the mid- to late-1980s, two new 4-in. RLW lines including manholes 21-221 and 21-222 were connected to building 21-209 to transport RLW to the SWMU 21-011(b) sump pump.

SWMU 21-011(b) is located east of the MDA T Nuclear Environmental Site (NES) boundary. The sump pump and a portion of the RLW line outside of the MDA T boundary were removed during 2011 investigation activities, and the site was backfilled to the surrounding site grade and seeded. The two manholes along the industrial waste lines associated with former buildings 21-155 and 21-152 (former structures 21-221 and 21-222) were partially removed. The concrete that formed the bottom of the manholes was left in place because the concrete was formed to the underlying tuff and was more than 10 ft below ground surface (bgs). The waste line extending from manhole 21-221 to 21-222 was left in place and partially grouted because of an active fire water line running parallel to, and several feet shallower than, the waste line. Two sections of drainline adjacent to the road between MDA A and MDA T were also left in place.

4.1.2 Nature and Extent of Contamination and Risk

The 2018 investigation report (N3B 2018, 700160) concluded the vertical extent of contamination has been defined or no further sampling for vertical extent is warranted at SWMU 21-011(b) except for the following:

- vertical extent of plutonium-239/240 at location 21-613847

Lateral extent beyond the waste line footprint is not applicable because contamination from the waste line would have traveled vertically and not laterally (gravity flow). Therefore, lateral extent of contamination was not evaluated for the drainline portion of SWMU 21-011(b).

Plutonium-239/240 activities decreased with depth at location 21-613847 from 1620 pCi/g at 6.0–7.0 ft bgs to 596 pCi/g at 8.0–9.0 ft bgs, and no samples were collected below 9.0 ft bgs. Although activities decreased with depth, the activity in the deeper sample was approximately 7.5 times the residential SAL and 3 times the construction worker SAL, and further sampling was warranted to define the extent of contamination exceeding the residential SAL.

Based on the risk-screening assessment results in the 2018 investigation report (N3B 2018, 700160) SWMU 21-011(b) does not pose potential unacceptable risks for the construction worker and residential scenarios. There are potential unacceptable doses for the construction worker and residential scenarios at SWMU 21-011(b) due to plutonium-239/240. SWMU 21-011(b) was not evaluated under the industrial risk scenario because no samples were collected from the 0.0–1.0-ft depth interval (i.e., the underground

drainline did not result in releases to the surface). The approved 2018 investigation report (LANL 2018, 700160) concluded there was no potential unacceptable risk to ecological receptors at SWMU 21-011(b).

The human health risk screening evaluation showed potential unacceptable dose for the construction worker and residential scenarios (30 mrem/yr and 70 mrem/yr, exceeding the DOE target of 25 mrem/yr) due to plutonium-239/240. The only results exceeding the construction worker or residential SALs were the two samples collected at location 21-613847. All other results were less than 10% of the construction worker and residential SALs. Calculation of construction worker and residential dose without the results from samples collected at location 21-613847 yields doses of approximately 0.3 mrem/yr and 4 mrem/yr, respectively.

4.1.3 Proposed Activities at SWMU 21-011(b)

Soil/tuff contaminated with plutonium-239/240 greater than the construction worker SAL will be removed. The lateral and vertical extent of soil/tuff requiring removal has not been defined, and sampling to define extent will be done before removal. Samples will be collected from four stepout locations approximately 5 ft from location 21-613847 along the former drainline and outward from the former drainline (locations 11b-1 through 11b-4 in Figure 4.1-1). At each stepout location, samples will be collected from depth intervals of 6.0–7.0 ft bgs, 8.0–9.0 ft bgs, 11.0–12.0 ft bgs, and 14.0–15.0 ft bgs. At location 21-613847, which has already been sampled at depth intervals of 6.0–7.0 ft bgs and 8.0–9.0 ft bgs, samples will be collected at depth intervals of 11.0–12.0 ft bgs and 14.0–15.0 ft bgs to define vertical extent of plutonium-239/240. All samples will be submitted for analysis of isotopic plutonium. If results from this sampling are greater than the residential SAL, additional samples will be collected at greater depths and/or distances until extent is defined. Table 4.1-1 summarizes the proposed sampling locations, depths, and analytical suites. Soil/tuff will be excavated from the area to a depth bounded by the above sampling intervals and after sampling is complete, the excavation will be backfilled with clean fill.

As noted above, sections of drainline adjacent to an active water line (i.e., between manholes 21-221 and 21-222) and between MDAs A and T were left in place. Most utility lines have now been deactivated and the sections of drainline that were left in place and the remaining portions of manholes 21-221 and 21-222 will be removed. All planned samples along these sections of drainline were collected and no additional sampling is necessary.

The sump (former structure 21-223) was removed only to a depth of 10 ft bgs. The sump is estimated to extend at least 15 ft belowgrade. Because the sump was not entirely removed, samples planned for collection at three depths below the sump were not collected. The remainder of the sump will be removed and samples will be collected beneath the sump (location 11b-5 in Figure 4.1-1) as described in the Phase I investigation work plan (LANL 2009, 108166.9). Samples will be collected from the depth intervals below the bottom of the sump specified in the Phase I investigation work plan (0.0–1.0 ft, 5.0–6.0 ft, and 10.0–11.0 ft below the bottom of the sump). Samples will be analyzed for the constituents specified in the Phase I investigation work plan (target analyte list [TAL] metals, nitrate, perchlorate, cyanide, semivolatile organic compounds [SVOCs], volatile organic compounds [VOCs], explosive compounds, dioxins/furans, polychlorinated biphenyls [PCBs], americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic uranium, strontium-90, and tritium). Table 4.1-1 summarizes the proposed sampling locations, depths, and analytical suites. As specified in the response to NMED's draft comments (Rich 2018, 700174), available site records will be reviewed to determine whether the inspection records for the sump are available. If so, they will be included in the report documenting field activities.

An approximately 50-ft section of the drainline on the west and north sides of former building 21-155 was abandoned in place because it was encased in 2 ft of concrete foundation left in place by the D&D operations. As a result, samples could not be collected at two proposed sampling locations (at the 90-degree bend in the drainline at the northwest corner of former building 21-155 and midway between this location and location 21-613839). This section of waste line and concrete foundation will be removed and samples will be collected beneath the line (locations 11b-6 and 11b-7 in Figure 4.1-1) as described in the "Investigation Work Plan for Delta Prime Site Aggregate Area Delayed Sites, Revision 1" (LANL 2009, 108166.9) (hereafter the Delayed Sites investigation work plan). Samples will be collected from the depth intervals below the waste line specified in the Delayed Sites investigation work plan (0.0–1.0 ft and 2.0–3.0 ft below the drainline foundation). Samples will be analyzed for the constituents specified in the Delayed Sites investigation work plan (TAL metals, nitrate, perchlorate, cyanide, SVOCs, VOCs, americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic uranium, strontium-90, and tritium). Table 4.1-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.2 SWMU 21-022(h), Sump, Drainline, and Outfall

4.2.1 Site Description

SWMU 21-022(h) consists of a former sump (former structure 21-202), inlet and outlet drainlines, and a former National Pollutant Discharge Elimination System (NPDES)-permitted outfall (EPA 03A032) south of former building 21-150 in the south-central portion of TA-21 (Figure 4.2-1). Building 21-150 was constructed in 1963 as a plutonium fuels development building including the development of plutonium-238 heat sources for space electric power applications. Building 21-150 became operational in 1963, along with the SWMU 21-022(h) sump system, including structure 21-202, directly south of the southeast corner of former building 21-150. Former structure 21-202 consisted of a 36-in.-diameter corrugated metal pipe designed to receive industrial wastewater from the building 21-150 basement floor and roof drains and route effluent through a 150-ft-long, 6-in.-diameter drainline that discharged to an outfall in Los Alamos Canyon. Releases of plutonium-238 occurred in several rooms in former building 21-150, on soil adjacent to and the roof above room 605A, and from leaky vacuum pumps in the basement. Building 21-150 was decontaminated between 1978 and 1981 to allow continued occupancy for non-plutonium research operations. All plutonium processing equipment was removed, along with the building roof and soil contamination outside room 605A. The circulating chilled-water system was decontaminated and left in place for continued use. The Laboratory's Inorganic and Structural Chemistry Group (INC-4) began operating former building 21-150 as a molecular chemistry laboratory with offices in the early 1980s. By 1991, the 6-in.-diameter outlet drainline had been replaced with a 24-in.-diameter drainline, and only treated cooling water was being discharged to the SWMU 21-022(h) sump system and outfall. Building 21-150 was subsequently decommissioned in the early 1990s.

The SWMU 21-022(h) sump (structure 21-202) and associated inlet and outlet drainlines were removed in 2007. The section of the outlet drainline located beneath the southern branch of DP Road was left in place because the road was and remains active to access DP East. Building 21-150 was demolished down to the concrete slab in November 2010.

4.2.2 Nature and Extent of Contamination and Risk

The approved Phase III investigation report (LANL 2016, 601598) concluded the nature and extent of contamination have been defined and no further sampling for extent is warranted at SWMU 21-022(h).

Based on the risk-screening assessment results in the approved Phase III investigation report (LANL 2016, 601598), SWMU 21-022(h) does not pose unacceptable carcinogenic risks or doses for the industrial or construction worker scenarios or potential unacceptable dose for the residential scenario. There are potential unacceptable noncarcinogenic risks for the industrial, construction worker, and residential scenarios due to lead at the outfall area and potential unacceptable carcinogenic risks for the residential scenario due to polycyclic aromatic hydrocarbons (PAHs) at the outfall area. The approved Phase III investigation report (LANL 2016, 601598) concluded there was no potential unacceptable risk to ecological receptors at SWMU 21-022(h).

The "Phase III Letter Work Plan for DP Site Aggregate Area" (LANL 2011, 203659) indicated that the area below the outfall where elevated lead and PAHs were present could not be safely excavated because of the steep topography, and no activities other than extent sampling were performed during the Phase III investigation. The mesa-top portion of SWMU 21-022(h) above the outfall area was evaluated separately for potential risk to human health because the outfall area where elevated lead and PAHs were detected is on a steep slope/cliff, with 45- to 90-degree slopes and is therefore not accessible to residents, construction workers, industrial workers, or trail users. The steep slope/cliff portion of the site will not result in human exposure to the residual contamination. The approved Phase III investigation report (LANL 2016, 601598) concluded the mesa-top portion of SWMU 21-022(h) poses no potential unacceptable risk to construction worker or residential receptors and poses no potential ecological risk. Risk to industrial receptors was not evaluated on the mesa top because samples were not collected from the 0.0–1.0-ft depth interval. An inspection of the site by NMED, DOE, and Newport News Nuclear BWXT-Los Alamos, LLC (N3B) on July 19, 2018, resulted in the determination that the area on the upper slope beneath the outfall could safely be remediated (N3B 2018, 700045).

The human health risk screening evaluation showed potential unacceptable noncarcinogenic risk for the industrial, construction worker, and residential scenarios (HIs of 2, 1, and 2, respectively, exceeding or equivalent to the NMED target of 1). The elevated risk was due to lead. The only result exceeding the industrial, construction worker, or residential SSLs was the surface sample (0–0.5 ft bgs) collected at location 21-600245. Calculation of industrial, construction worker, and residential HIs without the results from the sample collected at location 21-600245 yields HIs of approximately 0.1, 0.2, and 0.3, respectively.

The human health risk screening evaluation showed potential unacceptable carcinogenic risk for the residential scenario (risk of 1×10^{-4} [8×10^{-5} using 2019 SSLs], exceeding the NMED target of 1×10^{-5}). The elevated risk was due to PAHs, primarily dibenz(a,h)anthracene (6×10^{-5}). This risk is likely overestimated, however, since dibenz(a,h)anthracene was detected in only 3 of 30 samples. Because of the low frequency of detection, an upper confidence limit could not be calculated and the maximum detected concentration was used as the exposure point concentration.

4.2.3 Proposed Activities

Based on discussions during the July 19, 2018, site inspection, soil around sample location 21-600245 where lead was detected above SSLs will be removed (N3B 2018, 700045). Soil will be removed to a distance of approximately 1 ft from the sample location to a depth of approximately 0.5 ft bgs. Rocks were observed to be present in this area and rocks within the planned removal area will not be removed, but the soil between the rocks will be removed. Because nature and extent of lead contamination is defined, no additional sampling is needed. The original grade will be restored by filling with clean fill after the soil is removed.

4.3 AOC 21-028(d), Former Container Storage Area

4.3.1 Site Description

AOC 21-028(d) consists of a former container storage area located on a concrete loading dock adjacent to the north wing of former building 21-209 at TA-21. The dock dimensions were approximately 8.5 ft wide by 60 ft long by 3.25 ft deep. The dock and foundations were removed in 2010 along with building 21-209 during D&D activities. The site was covered with approximately 1 ft of clean backfill/gravel.

Storage of containers on the loading dock likely began in 1965 when building 21-209 was constructed. In 1988, a registered less-than-90-day waste storage area and a registered satellite accumulation area were located on the dock. Wastes stored on the dock included 55-gal. drums of lithium-deuterium waste; 30- and 55-gal. drums of fissionable waste (waste containing natural uranium, natural thorium, uranium-235, uranium-238, thorium-228, thorium-230, and thorium-232); and gas cylinders of tritium-contaminated hydrogen and argon gas. Product containers stored in the same area included cylinders of deuterium, argon, nitrogen, helium, and compressed hydrogen; 55-gal. drums of oil; acetone; Convoil 20 (a multipurpose vacuum pump fluid); ethanol; and various solvents stored in a chemical safety cabinet.

4.3.2 Nature and Extent of Contamination and Risk

The 2018 investigation report (N3B 2018, 700160) concluded the vertical extent of contamination has been defined or no further sampling for lateral extent is warranted at AOC 21-028(d) except for the following:

- lateral extent of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene at location 21-614376

Location 21-614376 is at the southwest corner of the former loading dock. The maximum concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene were detected at location 21-614376. Extent is defined to the north by decreasing concentrations at location 21-614375, but samples were not collected to the south, east, or west of location 21-614376.

Based on the risk-screening assessment results in the 2018 investigation report (N3B 2018, 700160) AOC 21-028(d) does not pose a potential unacceptable risk or dose under the industrial or construction worker scenarios or potential unacceptable noncarcinogenic risk or dose for the residential scenario. There is potential unacceptable carcinogenic risk for the residential scenario at AOC 21-028(d) due to PAHs. The approved Phase III investigation report (LANL 2016, 601598) concluded there was no potential unacceptable risk to ecological receptors at AOC 21-028(d).

4.3.3 Proposed Activities

Sampling will be performed to define the lateral extent of PAHs at location 21-614376. Samples will be collected at 3 step-out locations approximately 10 ft to the west, east, and south of location 21-614376 (locations 28d-1 through 28d-3 in Figure 4.3-1). Samples will be collected at the same depths as the Phase I investigation (1.0–2.0 ft, 5.0–6.0 ft, and 10.0–11.0 ft bgs) and analyzed for PAHs.

Table 4.3-1 summarizes the proposed sampling locations, depths, and analytical suites.

The site does not pose potential unacceptable risk under the industrial and construction worker scenarios, which apply to the current and planned future land use. Therefore, corrective actions to address potential unacceptable risk under the residential scenario are not proposed.

4.4 AOC C-21-001, Hydrogen Fluoride Release

4.4.1 Site Description

AOC C-21-001 is the location of a hydrogen fluoride release that occurred in the 1950s in the utility tunnel under the southeast portion of former building 21-4 in DP West at TA-21. Plutonium processing buildings in DP West including former Building 21-4 were constructed with utility tunnels that circled the perimeter of each building. The utility tunnels contained water, vacuum, chilled cooling water, air, steam, acid waste, acid supply, and caustic lines serving each building. These lines were connected to the interior of the buildings by pipe troughs passing through all of the major rooms. The utility tunnels are 4 ft wide by 4 ft deep with dirt floors. Typically, there were six entrances to each building's utility tunnels: access airways at the north and south ends, two access manholes on the east side, and two access manholes on the west side of each building.

In March 1962, two holes were discovered in the dirt floor of the utility tunnel beneath the southeast corner of building 21-4. The first hole was located approximately 15 ft south of the tunnel entrance situated at the middle of the east wall of the south building wing. This hole was oval in shape with a diameter of about 1 to 1.5 ft and appeared to continue at this diameter to a depth of 30 ft below the tunnel floor. An open joint or fracture in the Bandelier tuff beneath that portion of the building trending west-southwest coincided with the south wall of the hole. The tuff joint, angling southward about 10 degrees, was approximately one-quarter in. wide and filled with sediment and roots in the upper several feet. Below that, the tuff joint could not be distinguished, but the hole was observed continuing downward at the same angle. The wall of the hole appeared serrated or bumpy suggesting the original opening, probably the tuff joint, was enlarged by a strong solvent or acid. Only the upper 8 to 10 ft of the hole was visible because it is located directly beneath the footing of building 21-4 (Abrahams 1962, 033167). Notes from 1979 indicate this hole and/or pit was covered by plywood and tar and never investigated or remediated (Walker 1979, 006460). The operable unit work plan for TA-21 (LANL 1991, 007529) indicated the holes and/or pits may have been formed by the leaching action of acidic fluids, primarily hydrogen fluoride, from acid waste lines in the utility tunnel.

The second hole in the tunnel floor was located approximately 8 ft south of the tunnel entrance situated at the middle of the east wall of the south building wing. This hole is part of a tuff joint about 4 in. wide and 2 ft long and was part of a joint/fracture in the tuff; it was bridged with dirt at a depth of 2 ft, but a 12-ft rod was able to be pushed through the bridge. This joint appeared to continue downward to an undetermined depth but did not appear to have been enlarged by releases of solvents or acids (Abrahams 1962, 033167).

Building 21-4 underwent D&D in 1995 and the north and south wings were removed; however, the central corridor area of the building slab and utility tunnel remain in place. The utility tunnels in the north and south wings were backfilled with crushed concrete following D&D.

4.4.2 Nature and Extent of Contamination and Risk

No previous investigations have been conducted at this site and no decision-level data are available. Nature and extent of contamination and risk have not been evaluated.

4.4.3 Proposed Activities

Sampling to characterize potential releases from former building 21-4, including the utility tunnels, is specified in the Delayed Sites investigation work plan (LANL 2009, 108166.9) and will be performed as part of the DP West Slabs D&D and Remediation Project. Sampling to define the nature and extent of contamination at AOC C-21-001 will be performed in conjunction with the Delayed Sites investigation work plan sampling. Sample locations 90, 91, 92, and 138 specified in the Delayed Sites investigation work plan (LANL 2009, 108166.9) (see Figure 4.4-1) are along and downgradient of the utility tunnel in the vicinity of AOC C-21-001 and these samples will be used to characterize nature and extent of contamination for AOC C-21-001. Samples will be collected at depth intervals of 0–1 ft, 4–5 ft, and 9–10 ft below the bottom of the utility tunnel floor. All samples will be analyzed for TAL metals, nitrate, perchlorate, cyanide, SVOCs, VOCs, americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic uranium, strontium-90, and tritium. Table 4.4-1 summarizes the proposed sampling locations, depths, and analytical suites.

Because releases from this site would have been below 1 ft bgs, there would be no complete pathway for the industrial exposure scenario. If the results indicate unacceptable risk or dose under the construction worker scenario, soil/tuff contaminated above construction worker SSLs/SALs will be removed and confirmation samples will be collected to verify cleanup.

4.5 AOC C-21-006, Potential Soil Contamination

4.5.1 Site Description

AOC C-21-006 consists of an area of potential soil contamination from a 1977 release of americium-241 RLW from a leaking waste transport trailer staged near the southwestern corner of former building 21-2 in DP West at TA-21. The contaminated area was covered with asphalt after the spill/release to prevent contaminant migration. Since 1977, this area has been extensively disturbed and the location of the asphalt is no longer visible.

Building 21-2 was constructed in 1945 and housed plutonium processing operations. In the early 1950s room 218 was added onto the west side of the south wing of former building 21-2. From the early 1950s to 1979, tanker-trailers were loaded on the north side of room 218 at former building 21-2 with RLW generated from plutonium processing activities. On occasion, overflow from the RLW tanker trailers reportedly occurred south of building 21-2 to Los Alamos Canyon. Trailers were loaded by pulling a vacuum on the trailer tank. When the RLW tanker-trailers were full, they were moved to the former RLWTF in building 21-257, where the contents were emptied and treated. The RLWTF in building 21-257 did not begin operation until 1968; therefore, RLW generated during plutonium processing operations in former building 21-2 and loaded into tanker-trailers between the early 1950s and 1968 was likely transported to the former RLWTF in former building 21-35 [SWMU 21-010(a)], which operated from 1952 to 1967.

In 1977, a RLW transport trailer leaked resulting in a large area of americium-241 contamination (up to 5×10^4 counts/min/100 cm^2). It is not clear how the tank leak occurred, because procedures for filling and emptying the tanks were in place. If the tank was to the overflow mark, the overflow of RLW should have flowed back into the plant or into the vacuum system and associated traps on the system. A 1977 memorandum indicated the spill area would be covered with asphalt. In 2010, all aboveground structures associated with building 21-2 were demolished and removed during D&D activities.

Currently, only the concrete building footprint, underground utility tunnels with some associated piping, and concrete-filled troughs remain. The exact location of the 1977 americium-241 spill is unclear; however, it would have been adjacent to the north side of former room 218 at the south wing of former building 21-2.

4.5.2 Nature and Extent of Contamination and Risk

Previous investigations at AOC C-21-006 are limited to a reconnaissance-level field survey performed in 2006 and no decision-level data are available. Nature and extent of contamination and risk have not been evaluated.

4.5.3 Proposed Activities

The nature and extent of contamination have not been defined at this site. A total of 60 samples will be collected from 15 locations to the north and west of room 218 in former building 21-2 (locations C6-1 through C6-15 in Figure 4.5-1). At each location, samples will be collected at 0.0–1.0 ft bgs, 2.0–3.0 ft bgs, 5.0–6.0 ft bgs, and 9.0–10.0 ft bgs. Samples will be analyzed for the same suites as for previous Phase I investigations at DP Site Aggregate Area (TAL metals, nitrate, perchlorate, cyanide, SVOCs, VOCs, americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic uranium, strontium-90, and tritium). As with previous Phase I investigations, 20% of the samples will also be analyzed for PCBs, explosive compounds, and dioxins/furans. Table 4.5-1 summarizes the proposed sampling locations, depths, and analytical suites. If extent of contamination is not defined by the proposed sampling, additional samples will be collected at greater depths and/or at step-out locations.

If the results indicate unacceptable risk or dose under the industrial or construction worker scenarios, soil/tuff contaminated above industrial and construction worker SSLs/SALs will be removed and confirmation samples will be collected to verify cleanup.

5.0 INVESTIGATION METHODS

A summary of investigation methods to be implemented is presented in Table 5.0-1. Summaries of the field investigation methods are provided below. Additional procedures may be added as necessary to describe and document activities affecting quality.

Chemical analyses will be performed by accredited off-site contract analytical laboratories using the most recent U.S. Environmental Protection Agency– (EPA-) and industry-accepted extraction and analytical methods for chemical analyses of analytical suites.

5.1 Establishing Sampling Locations

Proposed sampling locations are identified for each site based on engineering drawings, surveyed locations of existing structures, previous sampling locations, and topography or other features identified in the field. The coordinates of proposed locations will be obtained by georeferencing the points from the proposed sampling maps. The coordinates will be used to locate flags or other markers in the field using a differential global positioning system (GPS) unit. If any proposed sampling locations are moved because of field conditions, utilities, or other unexpected reasons, the new locations will be surveyed immediately following sample collection as described in section 5.2.

5.2 Geodetic Surveys

Geodetic surveys will be conducted to locate historical structures and to document field activities such as sampling and excavation locations. The surveyors will use a Trimble GeoXT handheld GPS or equivalent for the surveys. The coordinate values will be expressed in the New Mexico State Plane Coordinate System (transverse Mercator), Central Zone, North American Datum 1983. Elevations will be reported as per the National Geodetic Vertical Datum of 1929.

5.3 Field Screening

As sampling is primarily being conducted to define nature and extent based on previous investigations, field screening will be conducted mainly for health and safety purposes. However, if elevated field-screening levels are observed for the deepest sample collected from a specific sampling location, sample collection will continue until field-screening results show no elevated readings. N3B's proposed field-screening approach will be to (1) visually examine all samples for evidence of contamination and (2) screen for gross-alpha, -beta, and -gamma radioactivity. Based on site histories and previous Resource Conservation and Recovery Act facility investigation results, VOC contamination is not expected to be encountered and monitoring of VOCs will not be performed.

5.4 Sampling

Soil, fill, and tuff samples will be collected by the most efficient and least invasive method practicable. The methods will be determined by the field team based on site conditions, such as topography; the nature of the material to be sampled; the depth intervals required; and accessibility. Typically, samples will be collected using spade and scoop, hand auger, or drill rig. For all methods, samples for VOC analysis will be immediately transferred from the sampling tool to the sample container to minimize the loss of subsurface VOCs during the sample collection process. Containers for VOC samples will be filled as completely as possible, leaving no or minimal headspace, and sealed with a Teflon-lined cap.

5.4.1 Surface Sampling

Surface and shallow subsurface soil and sediment samples will be collected in accordance with N3B-SOP-ER-2001, R0, "Soil, Tuff, and Sediment Sampling." Stainless-steel shovels, spades, scoops, and bowls will be used for ease of decontamination. If the surface location is at bedrock, an axe or hammer and chisel may be used to collect samples.

5.4.2 Subsurface Samples

Subsurface samples will be collected using hand- or hollow-stem auger methods, depending on the depth of the samples and the material being sampled. A brief description of these methods is provided below.

5.4.2.1 Hand Auger

Hand augers or power-assisted augers may be used to drill shallow holes at locations that can be sampled without the use of a drill rig and at locations inaccessible by a drill rig. The hand auger is advanced by turning the auger into the soil or tuff until the barrel is filled. The auger is removed and the sample is placed in a stainless-steel bowl. Hand-auger samples will be collected in accordance with N3B-ER-SOP-2001, R0, "Soil, Tuff, and Sediment Sampling."

5.4.2.2 Hollow-Stem Auger

Boreholes will be drilled using a drill rig equipped with a hollow-stem auger. The hollow-stem auger consists of a hollow steel shaft with a continuous spiraled steel flight welded onto the exterior of the stem. The stem is connected to an auger bit; when the bit is rotated, it transports cuttings to the surface. The hollow stem of the auger allows insertion of drill rods, split-spoon core barrels, Shelby tubes, and other samplers through the center of the auger so samples may be retrieved during drilling operations.

A bottom plug or pilot bit can be fastened onto the bottom of the auger to keep out most of the soil and/or water that tends to clog the bottom of the augers during drilling. Drilling without a center plug is acceptable if the soil plug, formed in the bottom of the auger, is removed before sampling or installing a well casing. The soil plug can be removed by washing out the plug using a side-discharge rotary bit or auguring out the plug with a solid-stem auger bit sized to fit inside the hollow-stem auger.

During sampling, the auger will be advanced to just above the desired sampling interval. The sample will be collected by driving a split-spoon sampler into undisturbed soil/tuff to the desired depth. Samples will be collected in accordance with N3B-ER-SOP-2001, R0, “Soil, Tuff, and Sediment Sampling.”

Field documentation will include detailed borehole logs for each borehole drilled using the hollow-stem auger method. The borehole logs will document the matrix material in detail and will include the results of all field screening; fractures and matrix samples will be assigned unique identifiers.

5.4.3 Borehole Abandonment

All hollow-stem auger boreholes will be properly abandoned in accordance with N3B-ER-ERSS-SOP-5034, “Monitoring Well and Borehole Abandonment.” Shallow boreholes, with a total depth of 20 ft or less, will be abandoned by filling the borehole with bentonite chips and then hydrating the chips in 1- to 2-ft lifts. The borehole will be visually inspected while the bentonite chips are being added to ensure bridging does not occur.

Boreholes greater than 20 ft deep will be pressure-grouted from the bottom of the borehole to the surface using the tremie pipe method. Acceptable grout materials include cement or bentonite grout, neat cement, or concrete.

The use of backfill materials, such as bentonite and grout, will be documented in a field logbook with regard to volume (calculated and actual), intervals of placement, and additives used to enhance backfilling. All borehole abandonment information will be presented in the investigation report.

5.5 Excavation

Excavation of soil and removal of subsurface structures (sump and drainlines) at SWMU 21-011(b) and AOC 21-028(d) will be completed using a track excavator or backhoe. Removal of soil at SWMU 21-022(h) will be performed with hand tools. After confirmatory sampling and any necessary over-excavation work are completed, the excavation trenches will be backfilled with clean fill material or overburden (if it is suitable for reuse, as described in Appendix B).

5.6 Chain of Custody for Samples

The collection, screening, and transport of samples will be documented on standard forms generated by the Sample Management Office (SMO). These include sample collection logs, chain-of-custody forms, and sample container labels. Sample collection logs will be completed at the time of sample collection

and signed by the sampler and a reviewer who will verify the logs for completeness and accuracy. Corresponding labels will be initialed and applied to each sample container, and custody seals will be placed around container lids or openings. Chain-of-custody forms will be completed and signed to verify that the samples are not left unattended.

5.7 Quality Assurance/Quality Control Samples

Quality assurance and quality control samples will include field duplicate, equipment rinsate, and field trip blank samples. These samples will be collected following the current version of N3B-ER-SOP 20235, "Sample Containers, Preservation, and Field Quality Control." Field duplicate, rinsate, and trip blank samples will be collected at an overall frequency of at least 1 for every 10 regular samples as specified in Appendix F, Section I.B.4.f of the Consent Order.

5.8 Laboratory Analytical Methods

Analytical suites for samples to be collected include TAL metals, nitrate, perchlorate, total cyanide, SVOCs, VOCs, PCBs, explosive compounds, dioxins and furans, americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic uranium, strontium-90, technetium-99, and tritium. Analytical methods are summarized in Table 5.8-1. Sample collection and analysis will be coordinated with the SMO.

5.9 Health and Safety

The field investigations described in this investigation work plan will comply with all applicable requirements pertaining to worker health and safety. An integrated work document and a site-specific health and safety plan will be in place before fieldwork is performed.

5.10 Equipment Decontamination

Equipment for drilling and sampling will be decontaminated before and after sampling activities to minimize the potential for cross-contamination. Dry decontamination methods will be used to avoid the generation of liquid waste and to minimize waste generation. Dry decontamination uses disposable paper towels and over-the-counter cleaner, such as Fantastik or equivalent. All sampling and measuring equipment will be decontaminated in accordance with N3B-SOP-ER-2002 "Field Decontamination of Equipment."

Dry decontamination may be followed by wet decontamination, if necessary. Wet decontamination may include washing with a nonphosphate detergent and water, followed by a water rinse and a second rinse with deionized water. Alternatively, drilling/exploration equipment that may come in contact with the borehole will be decontaminated by steam cleaning, by hot water pressure-washing, or by another method before each new borehole is drilled. The equipment will be pressure-washed on a high-density polyethylene liner at a temporary decontamination pad. Cleaning solutions and wash water will be collected and contained for proper disposal. Decontamination solutions will be sampled and analyzed to determine the final disposition of the wastewater and the effectiveness of the decontamination procedures.

5.11 Waste Management

Wastes generated by the proposed investigation and remediation activities may include, but are not limited to, drill cuttings, contact waste such as personal protective equipment, excavated media and

structural debris, decontamination fluids, and all other waste that has potentially come into contact with contaminants.

All wastes generated during field investigation and remediation activities will be managed in accordance with N3B-EP-DIR-SOP-10021, "Characterization and Management of Environmental Programs Wastes," applicable EPA and NMED regulations, and DOE orders. Appendix B presents the waste management plan.

6.0 MONITORING PROGRAMS

Groundwater monitoring is not performed to specifically monitor potential releases from any of the sites in this investigation work plan. Monitoring of perched intermediate and regional groundwater to evaluate potential releases from all sites at TA-21 is performed under the Consent Order as described for the TA-21 Monitoring Group in the Interim Facility-Wide Groundwater Monitoring Plan. Monitoring results are reported annually to NMED.

Storm water runoff from certain SWMUs and AOCs at the Laboratory is monitored under a NPDES Individual Permit (IP). One of the sites addressed by this work plan, SWMU 21-022(h), is included in the IP, and runoff from SWMU 21-022(h) is monitored by Site Monitoring Area LA-SMA-6.34. IP monitoring results are reported annually to EPA.

7.0 SCHEDULE

Following approval of this work plan, the work will be implemented in in fiscal year (FY) 2020 and FY 2021. The investigation results will be reported in the TA-21 Delta Prime Site Aggregate Area final investigation report, which is presently a FY 2021 Consent Order target.

8.0 REFERENCES AND MAP DATA SOURCES

8.1 References

The following reference list includes documents cited in this plan. Parenthetical information following each reference provides the author(s), publication date, and ERID, ESHID, or EMID. This information is also included in text citations. ERIDs were assigned by the Laboratory's Associate Directorate for Environmental Management (IDs through 599999); ESHIDs were assigned by the Laboratory's Associate Directorate for Environment, Safety, and Health (IDs 600000 through 699999); and EMIDs are assigned by N3B (IDs 700000 and above). IDs are used to locate documents in N3B's Records Management System and in the Master Reference Set. The NMED Hazardous Waste Bureau and N3B maintain copies of the Master Reference Set. The set ensures that NMED has the references to review documents. The set is updated when new references are cited in documents.

Abrahams, J.H., Jr., March 23, 1962. "[Two Holes Found beneath Floor of Tunnel at DP West]," U.S. Geological Survey Ground Water Branch letter to C.W. Christenson (H-7 Group Leader) from J.H. Abrahams (USGS), Albuquerque, New Mexico. (Abrahams 1962, 033167)

Christensen, E.L., and W.J. Maraman, April 1969. "Plutonium Processing at the Los Alamos Scientific Laboratory," Los Alamos Scientific Laboratory report LA-3542, Los Alamos, New Mexico. (Christensen and Maraman 1969, 004779)

LANL (Los Alamos National Laboratory), May 1991. "TA-21 Operable Unit RFI Work Plan for Environmental Restoration," Vol. II (Chapters 14 to 16), Los Alamos National Laboratory document LA-UR-91-962, Los Alamos, New Mexico. (LANL 1991, 007529)

LANL (Los Alamos National Laboratory), March 2008. "Delta Prime Site Aggregate Area Investigation Report, Revision 1," Los Alamos National Laboratory document LA-UR-08-1834, Los Alamos, New Mexico. (LANL 2008, 102760)

LANL (Los Alamos National Laboratory), December 2009. "Investigation Work Plan for Delta Prime Site Aggregate Area Delayed Sites, Revision 1," Los Alamos National Laboratory document LA-UR-09-8180, Los Alamos, New Mexico. (LANL 2009, 108166.9)

LANL (Los Alamos National Laboratory), October 2010. "Response to the Notice of Disapproval for the Phase II Investigation Report for Delta Prime Site Aggregate Area, Technical Area 21," Los Alamos National Laboratory document LA-UR-10-6477, Los Alamos, New Mexico. (LANL 2010, 110772.4)

LANL (Los Alamos National Laboratory), May 2011. "Phase III Letter Work Plan for DP Site Aggregate Area," Los Alamos National Laboratory document LA-UR-11-2842, Los Alamos, New Mexico. (LANL 2011, 203659)

LANL (Los Alamos National Laboratory), September 2015. "Derivation and Use of Radionuclide Screening Action Levels, Revision 4," Los Alamos National Laboratory document LA-UR-15-24859, Los Alamos, New Mexico. (LANL 2015, 600929)

LANL (Los Alamos National Laboratory), July 2016. "Phase III Investigation Report for Delta Prime Site Aggregate Area at Technical Area 21, Revision 1," Los Alamos National Laboratory document LA-UR-16-24014, Los Alamos, New Mexico. (LANL 2016, 601598)

N3B (Newport News Nuclear BWXT-Los Alamos, LLC), August 10, 2018. "Clarification of Request for Certificates of Completion for Twenty-Two Solid Waste Management Units and Five Areas of Concern in the Delta Prime Site Aggregate Area," N3B letter (N3B-18-0137) to J. Kieling (NMED-HWB) from J. Legare (N3B) and D.S. Rhodes (EM-LA), Los Alamos, New Mexico. (N3B 2018, 700045)

N3B (Newport News Nuclear BWXT-Los Alamos, LLC), December 2018. "Investigation Report for DP Site Aggregate Area Sites at DP East, Revision 1," Newport News Nuclear BWXT-Los Alamos, LLC, document EM2018-0140, Los Alamos, New Mexico. (N3B 2018, 700160)

NMED (New Mexico Environment Department), March 7, 2019. "Risk Assessment Guidance for Site Investigations and Remediation, Volume 1, Soil Screening Guidance for Human Health Risk Assessments," February 2019 (Revision 1, 3/7/19), Hazardous Waste Bureau and Ground Water Quality Bureau, Santa Fe, New Mexico. (NMED 2019, 700500)

Rich, K., November 14, 2018. RE: NMED Draft comments IR DP Site AA Sites at DP East [and attachments]. E-mail message to R. Murphy (NMED-HWB) from K. Rich (N3B), Los Alamos, New Mexico. (Rich 2018, 700174)

Walker, L., May 31, 1979. "Notes from Conversation with B. Maraman and W. McNeese Concerning Possible Sites of Contamination in DP Area," Los Alamos, New Mexico. (Walker 1979, 006460)

8.2 Map Data Sources

Data sources used in original figures and/or plates created for this report are described below and identified by legend title.

Locations: ER Project Locations; Los Alamos National Laboratory, ESH&Q Waste and Environmental Services Division, 2010-2E; 1:2,500 Scale Data; 04 October 2010.

Removed Piping: Digitized from LANL/LASL engineering drawings as published, unknown publication date.

Piping: Digitized from LANL/LASL engineering drawings as published, unknown publication date.

Former dry well: Digitized from LANL/LASL engineering drawings as published, unknown publication date.

Former floor trench: Digitized from LANL/LASL engineering drawings as published, unknown publication date.

Former generator: Digitized from LANL/LASL engineering drawings as published, unknown publication date.

Former pit: Digitized from LANL/LASL engineering drawings as published, unknown publication date.

Former Floor drain: Digitized from LANL/LASL engineering drawings as published, unknown publication date.

Former holding pit: Digitized from LANL/LASL engineering drawings as published, unknown publication date.

Former 5 ft wide round pit: Digitized from LANL/LASL engineering drawings as published, unknown publication date.

Former loading dock: Digitized from LANL/LASL engineering drawings as published, unknown publication date.

Security fence: Security and Industrial Fences and Gates; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 29 November 2010.

Paved roads: Paved Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 29 November 2010.

Unpaved roads: Dirt Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 29 November 2010.

Communication line: Communication Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 08 August 2002; as published 29 November 2010.

Electric line: Primary Electric Grid; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 29 November 2010.

Gas line: Primary Gas Distribution Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 29 November 2010.

Sewer line: Sewer Line System; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 29 November 2010.

Steam line: Steam Line Distribution System; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 29 November 2010.

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Hypsography: Hypsography, 100, 20, 10, 2 Foot Contour Interval; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program; 1991.

Structures: Structures; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 29 November 2010.

Former structures: Former Structures of the Los Alamos Site; Los Alamos National Laboratory, ESH&Q Waste and Environmental Services Division, EP2010-1B; 1:2,500 Scale Data; 09 August 2010.

Road centerline: Road Centerlines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 15 December 2005; as published 29 November 2010.

Technical area: Technical Area Boundaries; Los Alamos National Laboratory, Site Planning & Project Initiation Group, Infrastructure Planning Office; September 2007; as published 13 August 2010.

Wells: Well Locations of the Environmental Restoration Project Database; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program, ER2003-0390; 03 June 2003.

MDA: Waste Storage Features; Los Alamos National Laboratory, Environment and Remediation Support Services Division, GIS/Geotechnical Services Group, EP2007-0032; 1:2,500 Scale Data; 13 April 2007.

PRS: Potential Release Sites; Los Alamos National Laboratory, ESH&Q Waste & Environmental Services Division, Environmental Data and Analysis Group, EP2010-1C; 1:2,500 Scale Data; 02 December 2010.

LANL area: LANL Areas Used and Occupied; Los Alamos National Laboratory, Site Planning & Project Initiation Group, Infrastructure Planning Office; 19 September 2007; as published 13 August 2010.

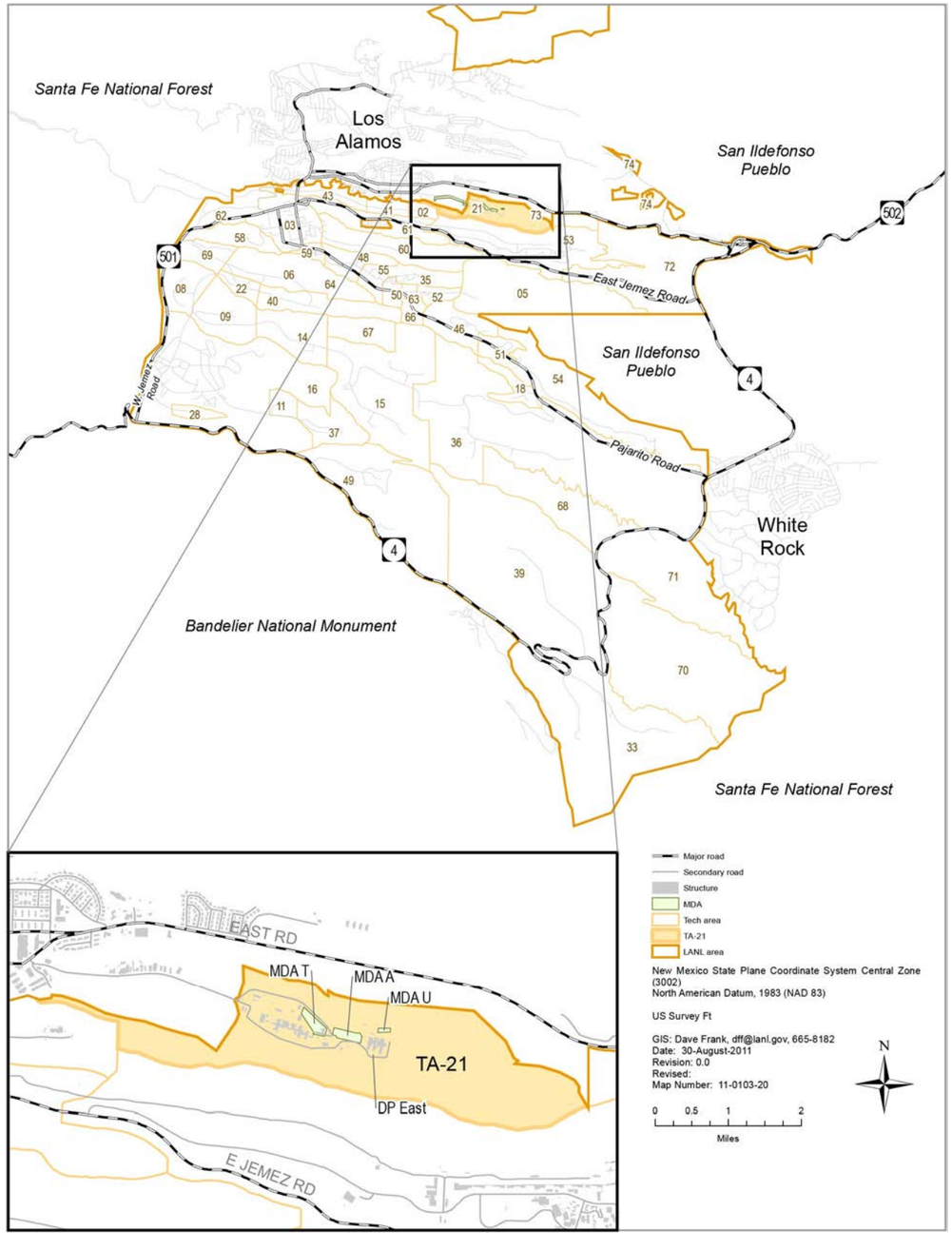

Figure 1.1-1 Location of TA-21 with respect to surrounding landholdings

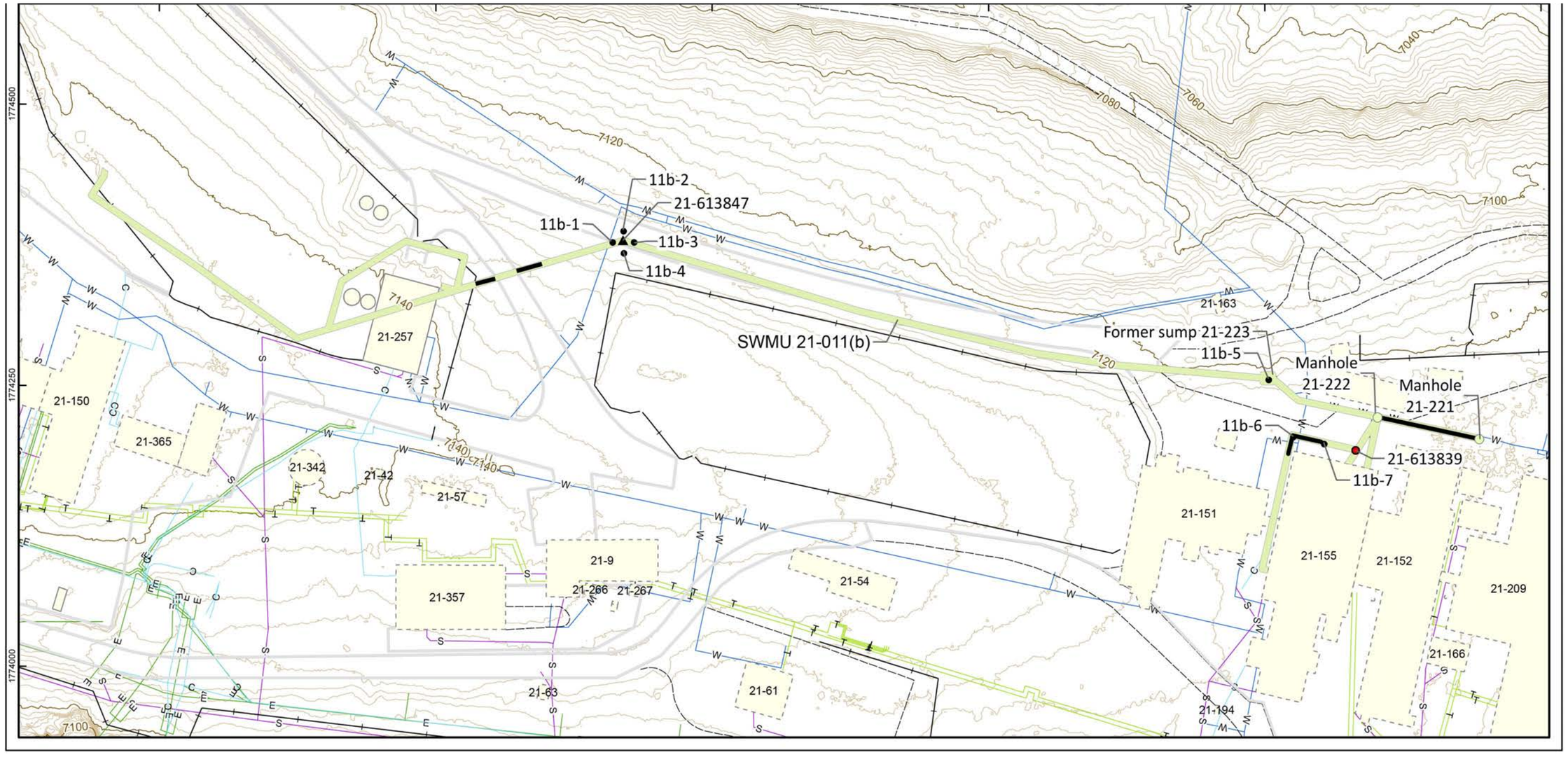

Figure 4.1-1 Site map and proposed sampling locations for SWMU 21-011(b)

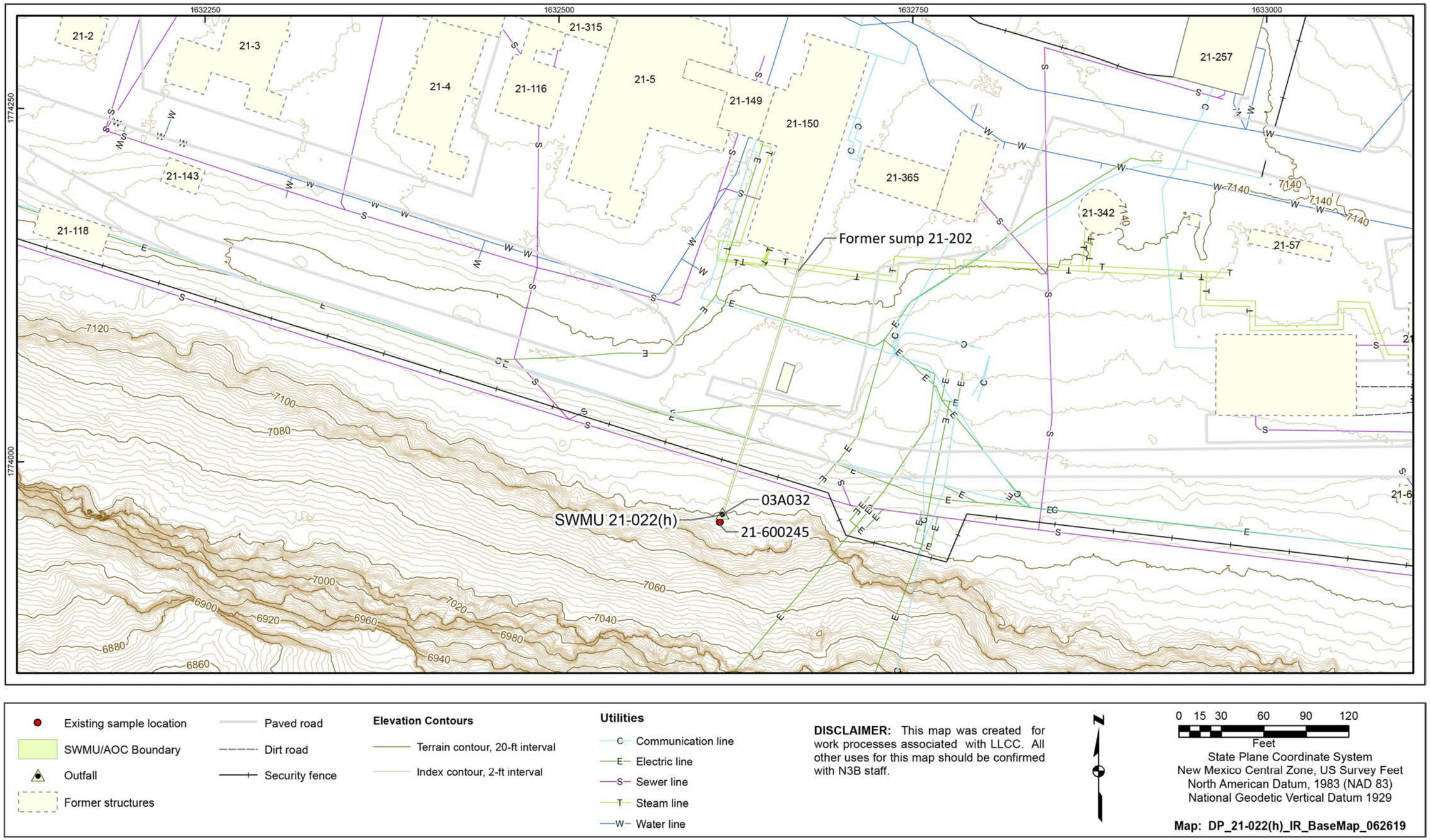

Figure 4.2-1 Site map for SWMU 21-022(h)

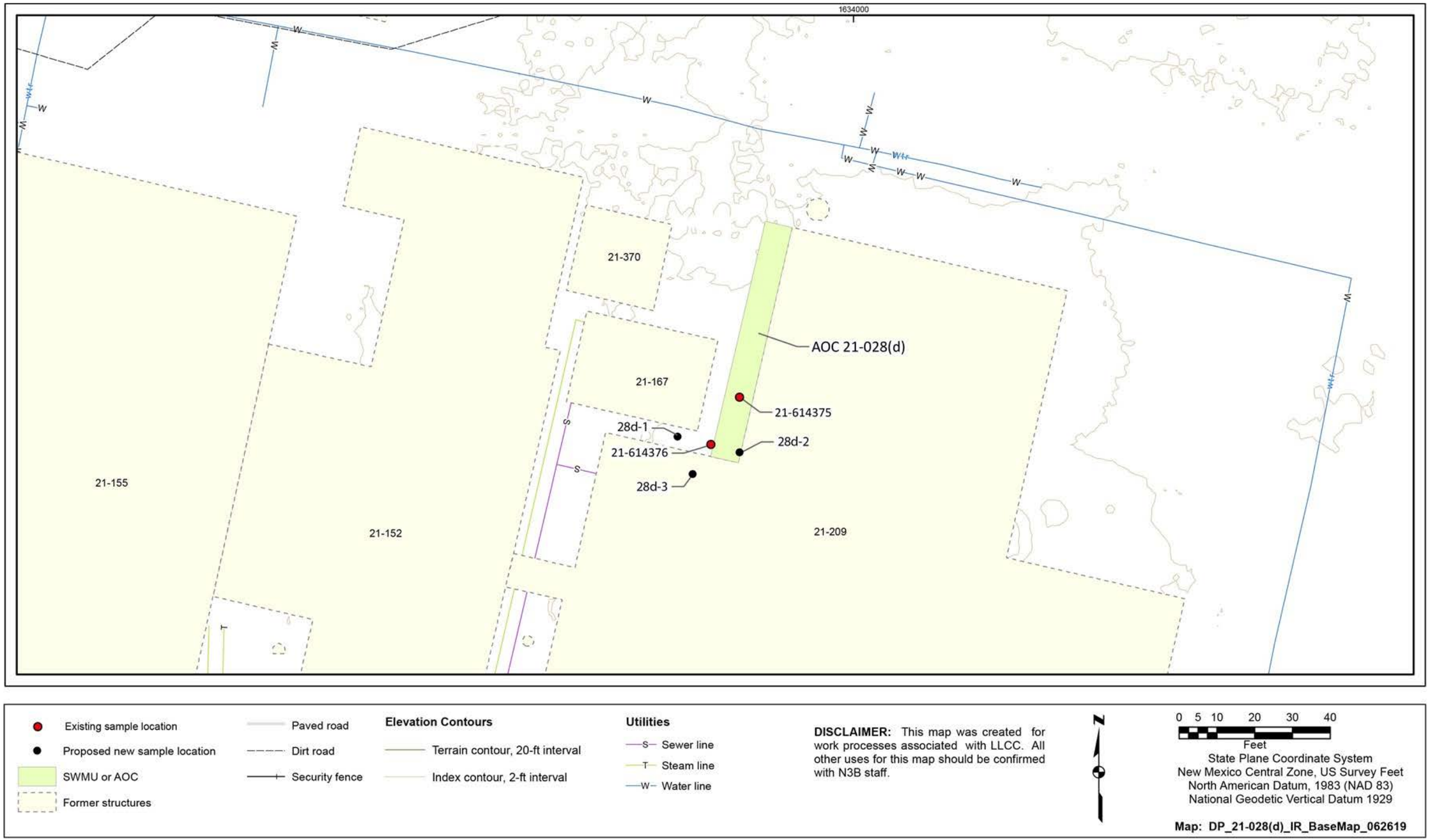

Figure 4.3-1 Site map and proposed sampling locations for AOC 21-028(d)

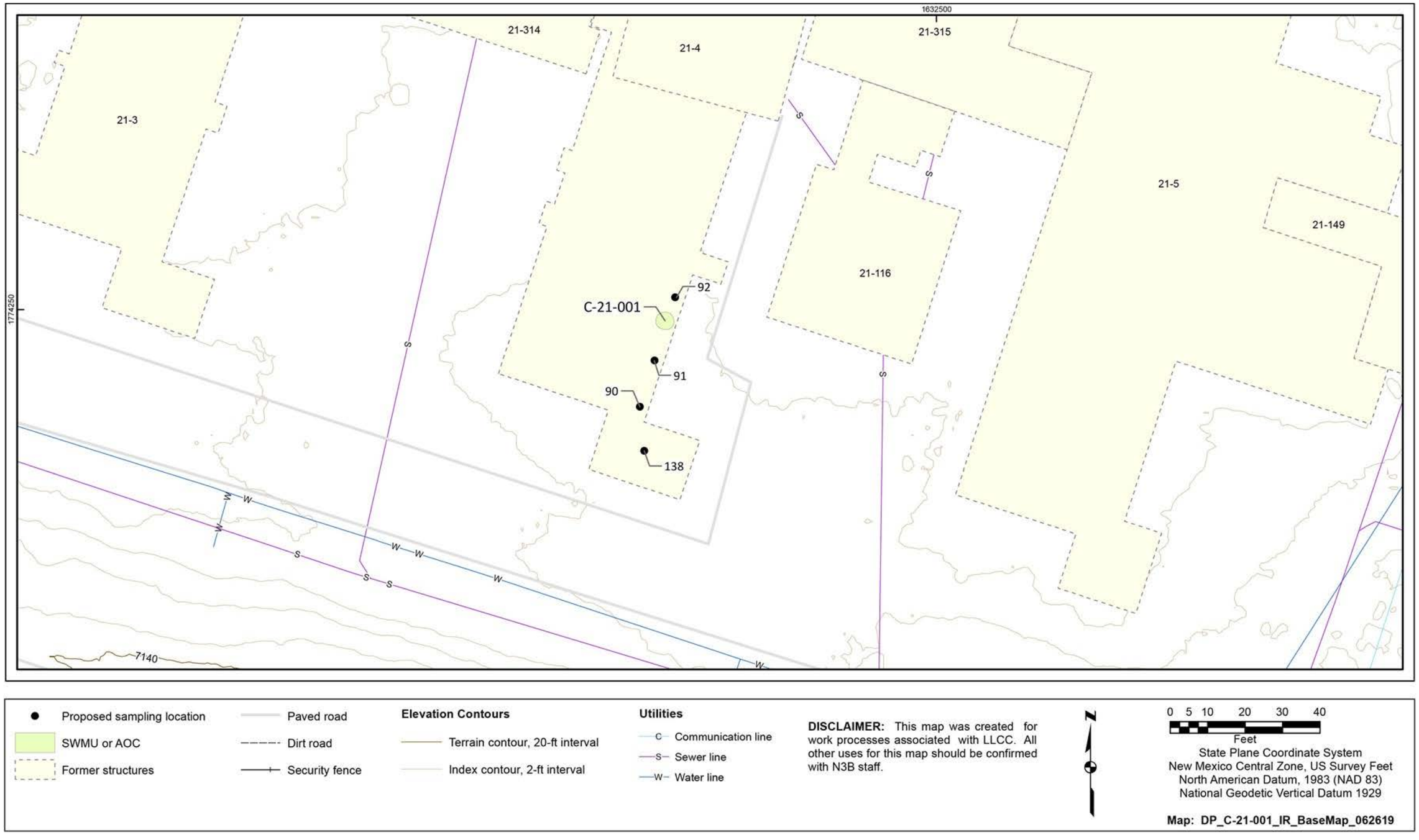

Figure 4.4-1 Site map and proposed sampling locations for AOC C-21-001

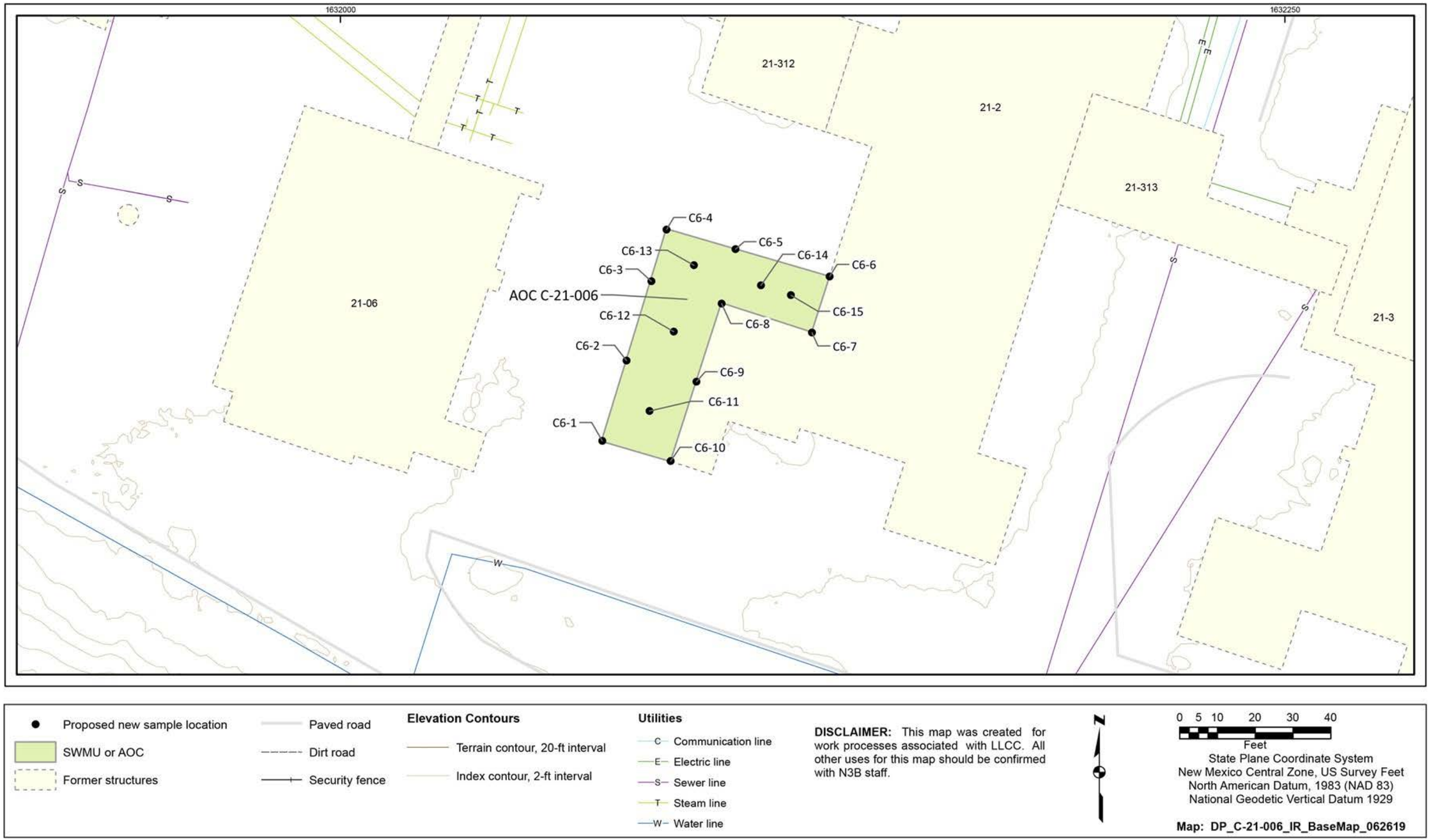

Figure 4.5-1 Site map and proposed sampling locations for AOC C-21-006

Table 1.1-1
Sites under Phase II Investigation in the DP Site Aggregate Area

SWMU/AOC	Site Description	Site Status	Proposed Activities
SWMU 21-011(b)	Sump and acid waste lines	Sump partially removed, drainlines east of Material Disposal Area T removed except for two segments, and samples collected at sump and along drainlines during 2010–2011. Vertical extent of plutonium-239/240 not defined at one location. Potential unacceptable dose from plutonium-239/240.	Additional sampling to define extent, soil removal, removal of remainder of sump, removal of drainline segments and concrete left in place during 2010–2011.
SWMU 21-022(h)	Sump, drainline, and outfall	Extent defined. Potential unacceptable risk at outfall area due to lead and PAHs*.	Removal of soil containing elevated lead.
AOC 21-028(d)	Former container storage area	Lateral extent of PAHs not defined at one location. Potential unacceptable risk from PAHs.	Additional sampling to define extent. Removal of soil containing elevated PAHs. Confirmation sampling following removal.
AOC C-21-001	Hydrogen fluoride release	Extent not defined and risk not evaluated.	Sampling to define extent and characterize risk. Remediate soil/tuff as necessary and resample.
AOC C-21-006	Potential soil contamination	Extent not defined and risk not evaluated.	Sampling to define extent and characterize risk. Remediate soil/tuff as necessary and resample.

* PAHs = Polycyclic aromatic hydrocarbons.

Table 4.1-1
Proposed Sampling and Analysis at SWMU 21-011(b)

Sampling Objective	Location Number	Location Description	Depth[a] (ft)	TAL Metals (EPA SW-846:6010B/6020)	Nitrate (EPA 300.0)	Perchlorate (EPA SW-846:6850)	Total Cyanide (EPA SW-846:9012A)	SVOCs (EPA SW-846:8270C)	VOCs (EPA SW-846:8260B)	Explosive Compounds (EPA SW-846:8321A_MOD)	Dioxins/Furans (EPA SW-846:8290)	PCBs (EPA SW-846:8082)	Americium-241 (HASL 300)	Gamma-Emitting Radionuclides (EPA 901.1)	Isotopic Plutonium (HASL-300)	Isotopic Uranium (HASL-300)	Strontium-90 (EPA 905.0)	Tritium (EPA 906.0)
Define lateral and vertical extent of area requiring excavation	11b-1	Step-out location approximately 5-ft west of location 21-613847.	6–7, 8–9, 11–12, 14–15	—[b]	—	—	—	—	—	—	—	—	—	—	X[c]	—	—	—
Define lateral and vertical extent of area requiring excavation	11b-2	Step-out location approximately 5-ft north of location 21-613847.	6–7, 8–9, 11–12, 14–15	—	—	—	—	—	—	—	—	—	—	—	X	—	—	—
Define lateral and vertical extent of area requiring excavation	11b-3	Step-out location approximately 5-ft east of location 21-613847.	6–7, 8–9, 11–12, 14–15	—	—	—	—	—	—	—	—	—	—	—	X	—	—	—
Define lateral and vertical extent of area requiring excavation	11b-4	Step-out location approximately 5-ft south of location 21-613847.	6–7, 8–9, 11–12, 14–15		—	—	—	—	—	—	—	—	—	—	X	—	—	—
Define vertical extent of plutonium-239/240 at location 21-613847	21-613847	Location 21-613847.	11–12, 14–15	—	—	—	—	—	—	—	—	—	—	—	X	—	—	—
Define vertical extent of contamination beneath sump 21-223	11b-5	Within footprint of sump 21-223.	0–1, 5–6, 10–11[d]	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Nature and extent adjacent to drainline at location where planned sample was not collected in 2010–2011.	11b-6	At the 90-degree bend in the drainline at the northwest corner of former building 21-155.	0–1, 2–3[e]	X	X	X	X	X	X	—	—	—	X	X	X	X	X	X
Nature and extent adjacent to drainline at location where planned sample was not collected in 2010–2011.	11b-7	Midway between new location 11b-6 and existing location 21-613839.	0–1, 2–3[e]	X	X	X	X	X	X	—	—	—	X	X	X	X	X	X

[a] Depths are below ground surface, unless otherwise noted.

[b] — = Analysis will not be performed.

[c] X = Analysis will be performed.

[d] Depths are below bottom of sump.

[e] Depths are below bottom of drainline.

Table 4.3-1
Proposed Sampling and Analysis at AOC 21-028(d)

Sampling Objective	Location Number	Location Description	Depth[a] (ft)	SVOCs (EPA SW-846:8270C)
Define lateral extent of PAHs at location 21-614376	28d-1	Approximately 10 ft west of existing location 21-614376	1–2, 5–6, 10–11	X[b,c]
Define lateral extent of PAHs at location 21-614376	28d-2	Approximately 10 ft east of existing location 21-614376	1–2, 5–6, 10–11	X
Define lateral extent of PAHs at location 21-614376	28d-3	Approximately 10 ft south of existing location 21-614376	1–2, 5–6, 10–11	X

[a] Depths are below ground surface.

[b] X = Analysis will be performed.

[c] PAHs only.

Table 4.4-1
Proposed Sampling and Analysis at AOC C-21-001

Sampling Objective	Location Number	Location Description	Depth[a] (ft)	TAL Metals (EPA SW-846:6010B/6020)	Nitrate (EPA 300.0)	Perchlorate (EPA SW-846:6850)	Total Cyanide (EPA SW-846:9012A)	SVOCs (EPA SW-846:8270C)	VOCs (EPA SW-846:8260B)	PCBs (EPA SW-846:8082)	Americium-241 (HASL 300)	Gamma-Emitting Radionuclides (EPA 901.1)	Isotopic Plutonium (HASL-300)	Isotopic Uranium (HASL-300)	Strontium-90 (EPA 905.0)	Tritium (EPA 906.0)
Define vertical extent of contamination beneath utility tunnel floor.	90, 91, 92[b]	Adjacent to north hole in utility tunnel floor.	0–1, 4–5, 9–10	X[c]	X	X	X	X	X	X	X	X	X	X	X	X
Define lateral extent of contamination south of utility tunnel floor.	138[b]	Approximately 50 ft south of south hole in utility tunnel floor.	0–1, 4–5, 9–10	X	X	X	X	X	X	X	X	X	X	X	X	X

[a] Depths are below utility tunnel floor.

[b] Location numbers from “Investigation Work Plan for Delta Prime Site Aggregate Area Delayed Sites, Revision 1,” (LANL 2009, 108166.9).

[c] X = Analysis will be performed.

Table 4.5-1
Proposed Sampling and Analysis at AOC C-21-006

Sampling Objective	Location Number	Location Description	Depth[a] (ft)	TAL Metals (EPA SW-846:6010B/6020)	Nitrate (EPA 300.0)	Perchlorate (EPA SW-846:6850)	Total Cyanide (EPA SW-846:9012A)	SVOCs (EPA SW-846:8270C)	VOCs (EPA SW-846:8260B)	Explosive Compounds (EPA SW-846:8321A_MOD)	Dioxins/Furans (EPA SW-846:8290)	PCBs (EPA SW-846:8082)	Americium-241 (HASL 300)	Gamma-Emitting Radionuclides (EPA 901.1)	Isotopic Plutonium (HASL-300)	Isotopic Uranium (HASL-300)	Strontium-90 (EPA 905.0)	Tritium (EPA 906.0)
Define lateral and vertical extent of contamination.	C6-1, C6-2, C6-3	20 ft west of building 21-2, room 218	0–1, 2–3, 5–6, 9–10	X[b]	X	X	X	X	X	—[c]	—	—	X	X	X	X	X	X
Define lateral and vertical extent of contamination.	C6-4	25 ft northwest of building 21-2, room 218	0–1, 2–3, 5–6, 9–10	X	X	X	X	X	X	—	—	—	X	X	X	X	X	X
Define lateral and vertical extent of contamination.	C6-5, C6-6	10 ft north of building 21-2, room 218	0–1, 2–3, 5–6, 9–10	X	X	X	X	X	X	—	—	—	X	X	X	X	X	X
Define lateral and vertical extent of contamination.	C6-7	1 ft north of building 21-2, room 218	0–1, 2–3, 5–6, 9–10	X	X	X	X	X	X	—	—	—	X	X	X	X	X	X
Define lateral and vertical extent of contamination.	C6-8, C6-9, C6-10	1 ft west of building 21-2, room 218	0–1, 2–3, 5–6, 9–10	X	X	X	X	X	X	X	X	—	X	X	X	X	X	X
Define lateral and vertical extent of contamination.	C6-11, C6-12, C6-13	10 ft west of building 21-2, room 218	0–1, 2–3, 5–6, 9–10	X	X	X	X	X	X	—	—	X	X	X	X	X	X	X
Define lateral and vertical extent of contamination.	C6-14, C6-15	4 ft north of building 21-2, room 218	0–1, 2–3, 5–6, 9–10	X	X	X	X	X	X	—	—	—	X	X	X	X	X	X

[a] Depths are below ground surface.

[b] X = Analysis will be performed.

[c] — = Analysis will not be performed.

Table 5.0-1
Summary of Investigation Methods

Method	Summary
Spade-and-Scoop Collection of Soil Samples	This method is typically used to collect shallow (e.g., approximately 0–12 in.) soil or sediment samples. The spade-and-scoop method involves digging a hole to the desired depth, as prescribed in the sampling and analysis plan, and collecting a discrete grab sample. The sample for VOC analysis is transferred immediately from the sampler to the sample container to minimize the loss of VOCs during the sample collection process. Containers for VOC samples are filled as completely as possible, leaving no or minimal headspace, and sealed with a Teflon-lined cap. The remaining sample material is typically placed in a clean stainless-steel bowl for transfer into various sample containers.
Hand-Auger Sampling	This method is typically used for sampling soil or sediment at depths of less than 10–15 ft but may in some cases be used for collecting samples of weathered or nonwelded tuff. The method involves hand-turning a stainless-steel bucket auger (typically 3–4 in. inside diameter), creating a vertical hole that can be advanced to the desired sampling depth. When the desired depth is reached, the auger is decontaminated before the hole is advanced to the sampling depth. The sample for VOC analysis is transferred immediately from the sampler to the sample container to minimize the loss of VOCs during the sample collection process. Containers for VOC samples are filled as completely as possible, leaving no or minimal headspace, and sealed with a Teflon-lined cap. The remaining sample material is transferred from the auger bucket to a stainless-steel sampling bowl before the various required sample containers are filled.
Hollow-Stem Auger Drilling Methods	In this method, hollow-stem augers (sections of seamless pipe with auger flights welded to the pipe) act as a screw conveyor to bring cuttings of sediment, soil, and/or rock to the surface. Auger sections are typically 5 ft in length and have outside diameters of 4.25 to 14 in. Drill rods, split-spoon core barrels, Shelby tubes, and other samplers can pass through the center of the hollow-stem auger sections for collection of discrete samples from desired depths. Hollow-stem augers are used as temporary casings when setting wells to prevent cave-ins of the borehole walls. If samples are to be collected for VOC analysis, the sampler will be lined with brass sleeves. Immediately upon retrieval of the sampler, it will be opened and a sleeve from the desired depth interval will be collected for VOC analysis. The ends of the sleeve will immediately be covered with Teflon film and capped with plastic caps. Tape will then be used to seal the ends of the cap to the sleeve. Material from the remaining sleeves will then be field screened, visually inspected, and placed in a stainless-steel bowl. Samples for the remaining analysis will then be transferred to appropriate sample containers, depending upon the analytical method requirement.
Handling, Packaging, and Shipping of Samples	Field team members seal and label samples before packing and ensure that the sample containers and the containers used for transport are free of external contamination. Field team members package all samples so as to minimize the possibility of breakage during transportation. After all environmental samples are collected, packaged, and preserved, a field team member transports the samples either to the Sample Management Office (SMO) or to an SMO-approved radiation screening laboratory under chain of custody (COC). The SMO arranges to ship samples to the analytical laboratories. The field team member must inform the SMO and/or the radiation screening laboratory coordinator when levels of radioactivity are in the action-level or limited-quantity ranges.

Table 5.0-1 (continued)

Method	Summary
Sample Control and Field Documentation	The collection, screening, and transport of samples are documented on standard forms generated by the SMO. These include sample container labels and combined sample collection log/COC forms. Sample collection portions of the combined forms will be completed at the time of sample collection and signed by the sampler and a reviewer who will verify the logs for completeness and accuracy. The COC portions of the combined forms will be completed and signed to verify the samples are not left unattended. Corresponding labels will be initialed and applied to each sample container, and custody seals will be placed around container lids or openings. Site attributes (e.g., former and proposed soil sampling locations, sediment sampling locations) are located by using a global positioning system (GPS) unit. Horizontal locations will be measured to the nearest 0.5 ft. The survey results for this field event will be presented as part of the investigation report. Sample coordinates will be uploaded into the Sample Management Database.
Field Decontamination of Drilling and Sampling Equipment	Dry decontamination is the preferred method to minimize generating liquid waste. Dry decontamination may include using a wire brush or other tool to remove soil or other material adhering to the sampling equipment, followed by using a commercial cleaning agent (nonacid, waxless cleaners) and paper wipes. Dry decontamination may be followed by wet decontamination if necessary. Wet decontamination may include washing with a nonphosphate detergent and water, followed by a water rinse and a second rinse with deionized water. Alternatively, steam cleaning may be used.
Containers and Preservation of Samples	Specific requirements/processes for sample containers, preservation techniques, and holding times are based on EPA guidance for environmental sampling, preservation, and quality assurance (QA). Specific requirements for each sample are printed on the sample collection logs provided by the SMO (size and type of container [glass, amber glass, polyethylene], preservative, etc.). All samples are preserved by placing them in insulated containers with ice to maintain a temperature of 4°C. Other requirements such as nitric acid or other preservatives may apply to different media or analytical requests.
Waste Management, Characterization, and Storage	Wastes are managed, characterized, and stored in accordance with an approved waste characterization strategy form that documents site history, field activities, and the characterization approach for each waste stream managed. Waste characterization complies with on-site or off-site waste acceptance criteria. All stored wastes will be marked with appropriate signage and labels, as appropriate. Drummed waste will be stored on pallets to prevent the containers from deterioration. Waste generators are required to reduce the volume of waste generated as much as technically and economically feasible. Means to store, control, and transport each potential waste type and classification shall be determined before field operations that generate waste begin. A waste storage area will be established before waste is generated. Waste storage areas located in controlled areas of the Laboratory will be controlled as needed to prevent inadvertent addition or management of wastes by unauthorized personnel. Each container of waste generated will be individually labeled as to waste classification, item identification number, and radioactivity (if applicable), immediately following containerization. All waste shall be segregated by classification and compatibility to prevent cross-contamination. Appendix B describes waste management.
Geodetic Surveys	This method describes the procedure for coordinating and evaluating geodetic surveys and establishing QA and QC for geodetic survey data. The procedure covers evaluating geodetic survey requirements, preparing to perform a geodetic survey, performing geodetic survey field activities, preparing geodetic survey data for QA review, performing QA review of geodetic survey data, and submitting geodetic survey data.

Table 5.8-1
Summary of Analytical Methods

Analyte	Analytical Method
TAL metals (aluminum, antimony, arsenic, barium, beryllium, calcium, cadmium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, sodium, silver, thallium, vanadium, zinc)	SW-846:6010B; SW-846:6020; SW-846:7471A (mercury)
Total cyanide	EPA SW-846:9012A
Perchlorate	SW-846:6850
Nitrate	EPA 300
SVOCs	SW-846:8270C
VOCs	SW-846:8260B
PCBs	SW-846:8082
Dioxins/furans	SW-846:8290
Explosive compounds	SW-846:8321A Modified
Americium-241	HASL-300:AM-241
Gamma-emitting radionuclides	EPA:901.1
Isotopic plutonium	HASL-300:ISOPU
Isotopic uranium	HASL-300:ISOU
Strontium-90	EPA 905.0
Technetium-99	HASL-300:TC-99
Tritium	EPA 906.0
pH	SW-846:9045C

Appendix A

Acronyms and Abbreviations,
Metric Conversion Table, and Data Qualifier Definitions

A-1.0 ACRONYMS AND ABBREVIATIONS

AOC	area of concern
AK	acceptable knowledge
bgs	below ground surface
BMP	best management practice
COC	chain of custody
Consent Order	Compliance Order on Consent
COPC	chemical of potential concern
D&D	decontamination and decommissioning
DOE	Department of Energy (U.S.)
DP	Delta Prime
EPA	Environmental Protection Agency (U.S.)
FY	fiscal year
GPS	global positioning system
HI	hazard index
IP	Individual Permit
LANL	Los Alamos National Laboratory
LLW	low-level waste
MDA	material disposal area
N3B	Newport News Nuclear BWXT-Los Alamos, LLC
NES	Nuclear Environmental Site
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
QA	quality assurance
QC	quality control
RLW	radioactive liquid waste
RLWTF	radioactive liquid waste treatment facility
SAL	screening action level
SMO	Sample Management Office
SOP	standard operating procedure
SSL	soil screening level
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TA	technical area
TAL	target analyte list

TRU	transuranic
TSTA	Tritium Systems Test Assembly
VOC	volatile organic compound
WAC	waste acceptance criteria
WCSF	waste characterization strategy form

A-2.0 METRIC CONVERSION TABLE

Multiply SI (Metric) Unit	by	To Obtain U.S. Customary Unit
kilometers (km)	0.622	miles (mi)
kilometers (km)	3281	feet (ft)
meters (m)	3.281	feet (ft)
meters (m)	39.37	inches (in.)
centimeters (cm)	0.03281	feet (ft)
centimeters (cm)	0.394	inches (in.)
millimeters (mm)	0.0394	inches (in.)
micrometers or microns (µm)	0.0000394	inches (in.)
square kilometers (km^2)	0.3861	square miles (mi^2)
hectares (ha)	2.5	acres
square meters (m^2)	10.764	square feet (ft^2)
cubic meters (m^3)	35.31	cubic feet (ft^3)
kilograms (kg)	2.2046	pounds (lb)
grams (g)	0.0353	ounces (oz)
grams per cubic centimeter (g/cm^3)	62.422	pounds per cubic foot (lb/ft^3)
milligrams per kilogram (mg/kg)	1	parts per million (ppm)
micrograms per gram (µg/g)	1	parts per million (ppm)
liters (L)	0.26	gallons (gal.)
milligrams per liter (mg/L)	1	parts per million (ppm)
degrees Celsius (°C)	9/5 + 32	degrees Fahrenheit (°F)

A-3.0 DATA QUALIFIER DEFINITIONS

Data Qualifier	Definition
U	The analyte was analyzed for but not detected.
J	The analyte was positively identified, and the associated numerical value is estimated to be more uncertain than would normally be expected for that analysis.
J+	The analyte was positively identified, and the result is likely to be biased high.
J-	The analyte was positively identified, and the result is likely to be biased low.
UJ	The analyte was not positively identified in the sample, and the associated value is an estimate of the sample-specific detection or quantitation limit.
R	The data are rejected as a result of major problems with quality assurance/quality control (QA/QC) parameters.

Appendix B

Waste Management Plan

B-1.0 INTRODUCTION

This appendix describes how wastes generated during the Phase II investigation of Delta Prime (DP) Site Aggregate Area Sites at DP East will be managed. Wastes may include, but are not limited to, drill cuttings, excavated media, overburden spoils, excavated man-made debris, contact waste, decontamination fluids, and all other waste that has potentially come into contact with contaminants.

B-2.0 WASTE STREAMS

All wastes generated during investigation and remediation activities will be managed in accordance with standard operating procedure (SOP) N3B-ER-DIR-SOP-10021, "Characterization and Management of Environmental Programs Waste." This SOP incorporates the requirements of all applicable U.S. Environmental Protection Agency (EPA) and New Mexico Environment Department (NMED) regulations and U.S. Department of Energy (DOE) orders.

A waste characterization strategy form (WCSF) will be prepared and approved per requirements of N3B-ER-SOP-10021. The WCSF will provide detailed information on waste characterization methods, management, containerization, and potential volumes. Waste characterization is completed through review of sampling data and/or documentation or by direct sampling of the waste or the media being investigated (e.g., surface soil, subsurface soil). Waste characterization may include a review of historical information and process knowledge to identify whether listed hazardous waste may be present (i.e., due diligence reviews). If low levels of listed hazardous waste are identified, a "contained in" determination may be submitted for approval to NMED. Data currently available for the sites addressed in this work plan do not identify polychlorinated biphenyl (PCB) concentrations greater than 1 mg/kg. However, if this investigation identifies PCB concentrations of greater than 1 mg/kg, Newport News Nuclear BWXT-Los Alamos, LLC (N3B) may submit a request to EPA (with a copy to NMED) to manage the waste as PCB remediation waste. Radioactive wastes are not expected to contain transuranic (TRU) levels of contamination (i.e., greater than 100 nCi/g). If characterization indicates TRU levels of contamination, the work will be stopped, NMED will be notified, and an evaluation of how to proceed will be developed.

Wastes will be containerized and placed in clearly marked and appropriately constructed waste accumulation areas. Waste accumulation area postings, regulated storage duration, and inspection requirements will be based on the type of waste and its classification. Container and storage requirements, as well as transportation and disposal requirements, will be detailed in the WCSF and approved before waste is generated. Table B-2.0-1 summarizes the estimated waste streams, waste types, waste volumes, and other data.

The waste streams that are anticipated to be generated during work plan implementation are described below.

B-2.1 Drill Cuttings

Drill cuttings consist of soil and tuff/rock chips generated by the drilling of boreholes for the intent of sampling. Drill cuttings include excess core sample not submitted for analysis and any returned samples sent for analysis. Drill cuttings will be containerized in IP-1 bags, 55-gal. drums, B-12 containers, or other appropriate containers at the point of generation. The initial management of the cuttings will rely on the data from previous investigations and/or process knowledge. Drill cuttings will be managed in secure, designated areas appropriate to the type of the waste. If new analytical data changes the expected waste category, the waste will be managed in accumulation areas appropriate to the final waste determination.

This waste stream will be characterized based either on direct sampling of the waste or on the results from core samples collected during drilling. The WCSF will specify the sampling suites for direct sampling of the waste stream. Additional constituents may be analyzed as necessary to meet the waste acceptance criteria (WAC) for a receiving facility or if visual observations indicate that additional contaminants may be present.

Cuttings will be land applied if they meet the criteria in the NMED-approved Notice of Intent Decision Tree for Land Application of Investigation-Derived Waste Solids from Construction of Wells and Boreholes. N3B expects that cuttings will be land applied or disposed of in accordance with the approved WCSF. Table B-2.0-1 presents the estimated volumes, characterization and management methods, and expected disposition of this waste stream.

B-2.2 Excavated Environmental Media

Excavated environmental media consists of contaminated soil and rock removed to meet the proposed cleanup levels where cleanup is recommended. The excavated material will be field-screened and examined for visible evidence of contamination during the excavation process. The excavated material will be placed in appropriate containers in accordance with the approved WCSF. Wastes will be segregated by site or source area if the expected waste classifications are different. A minimum of one direct sample will be collected from each 20 yd^3 or each container of material excavated and will be submitted for laboratory analyses for the analytical suites specified in the WCSF. N3B expects most of the excavated environmental media to be designated as nonhazardous waste, hazardous waste, or low-level radioactive waste (LLW) that will be disposed of in accordance with the approved WCSF. Table B-2.0-1 presents the estimated volumes, characterization and management methods, and expected disposition of this waste stream.

B-2.3 Overburden Spoils

Overburden spoils consists of soil above or adjacent to areas of known contamination that must be removed to access contaminated media or structures. Overburden spoils are expected to be uncontaminated, but will be field-screened and examined for visible evidence of contamination during the excavation process. If contamination is not detected during screening, the spoils will be stored either in rolloff bins, other suitable containers, or on the ground surface with appropriate best management practices (BMPs). If field screening indicates the potential for contamination, the spoils will be placed in rolloff bins or other suitable containers. A minimum of one direct sample will be collected from each 20 yd^3 or each container of material excavated and will be submitted for laboratory analyses for the analytical suites specified in the WCSF. If the spoils are determined to be suitable for reuse (i.e., is not hazardous waste and meets residential soil screening levels [SSLs] and screening action levels [SALs]), N3B will segregate any man-made debris from the soil and will use this soil to backfill the excavations. If the spoils do not meet residential SSLs/SALs or are determined to be hazardous waste, they will be treated/disposed of at an authorized facility appropriate for the waste regulatory classification. N3B expects overburden spoils will be suitable for backfilling excavations. Table B-2.0-1 presents the estimated volumes, characterization and management methods, and expected disposition of this waste stream.

B-2.4 Excavated Man-Made Debris

Excavated man-made debris will be generated from the removal of pipelines and a sump. Debris will be segregated as it is excavated based on factors such as the type of debris, field screening, process knowledge, and/or staining or odors. Where practicable, this waste stream will be characterized by direct sampling of the waste (e.g., concrete). Direct samples will be analyzed for the analytical suites specified

in the WCSF. For debris that is difficult to characterize, acceptable knowledge (AK) will be used whenever possible, supplemented by sampling as needed. N3B expects most of the excavated man-made debris to be designated as nonhazardous waste, hazardous waste, or LLW that will be disposed of in accordance with the approved WCSF.

Waste minimization will be implemented, where practicable, through segregation of waste materials. Nonhazardous materials that can be shown to have no detectable activity for radionuclides or that can be decontaminated to meet this criterion, will be recycled, if practicable.

B-2.5 Contact Waste

The contact waste stream consists of potentially contaminated materials that "contacted" other waste during sampling and excavation. This waste stream consists primarily of, but is not limited to, personal protective equipment such as gloves; decontamination wastes such as paper wipes; and disposable sampling supplies. Contact waste will be stored in containers and characterized in accordance with the approved WCSF.

Characterization of this waste stream will use AK based on data from the media with which it came into contact (e.g., drill cuttings, soil, sumps, etc.). N3B expects most of the contact waste to be designated as nonhazardous, nonradioactive waste that will be disposed of in accordance with the approved WCSF. Table B-2.0-1 presents the estimated volumes, characterization and management methods, and expected disposition of this waste stream.

B-2.6 Decontamination Fluids

The decontamination fluids waste stream will consist of liquid wastes from decontamination activities (i.e., decontamination solutions and rinse waters). Consistent with waste minimization practices, N3B employs dry decontamination methods to the extent possible. If dry decontamination cannot be performed, liquid decontamination wastes will be collected in containers at the point of generation. The decontamination fluids will be characterized through AK of the waste materials, the levels of contamination measured in the environmental media (e.g., the results of the associated drill cuttings), and, if necessary, direct sampling of the containerized waste. If directly sampled, samples will be analyzed for the analytical suites specified in the WCSF. N3B expects most of these wastes to be nonhazardous liquid waste or radioactive liquid waste that will be sent to facilities with a WAC allowing the waste to be received. Table B-2.0-1 presents the estimated volumes, characterization and management methods, and expected disposition of this waste stream.

Table B-2.0-1
Summary of Estimated Waste Generation and Management

Waste Stream	Expected Waste Type	Estimated Volume	Characterization Method	On-Site Management	Expected Disposition
Drill Cuttings	Nonhazardous nonradioactive waste or LLW	2 yd^3	Analytical results from direct sampling of waste or core samples	Accumulation in 55-gal. drums, IP-1 bags, or other appropriate containers	Land application, or permitted facility for which waste meets acceptance criteria
Excavated Environmental Media	Nonhazardous nonradioactive waste, hazardous waste, or LLW	30 yd^3	Analytical results from direct sampling of waste	Accumulation in 55-gal. drums, covered rolloff containers, or other appropriate containers	Permitted facility for which waste meets acceptance criteria
Overburden Spoils	Nonhazardous nonradioactive waste	30 yd^3	Analytical results from direct sampling of waste	On ground with BMPs, or accumulation in covered rolloff containers or other appropriate containers	Return to excavation or permitted facility for which waste meets acceptance criteria
Excavated Man-Made Debris	Nonhazardous nonradioactive waste or LLW	25 yd^3	Analytical results from direct sampling of waste or AK	Accumulation in covered rolloff containers or other appropriate containers	Permitted facility for which waste meets acceptance criteria
Contact Waste	Nonhazardous nonradioactive waste or LLW	0.5 yd^3	AK	Accumulation in 55-gal. drums	Permitted facility for which waste meets acceptance criteria
Decontamination Fluids	Nonhazardous nonradioactive waste or LLW	10 gal.	AK; analytical results from direct sampling of waste	Accumulation in 30-gal. plastic drums	Treatment at permitted facility for which waste meets acceptance criteria